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Journal of the Biological Photographic Association Vol. 28, No. 1 February, 1960

Automation Versus Professionalism*

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bio-Graphic Unit, Canada Dept. of Agriculture, Ottawa.

RAPID technological advances and changes in industrial production methods which have occurred during the past three decades often make us wonder how soon we—biological photographers—shall be overtaken by automation and, possibly, be replaced by a push-button.

For those who are intimately concerned about the future of our profession it might be a very serious, sometimes frightening question. Continuously we have witnessed various trades and professions reach the culminating point of their progressive development and, because of certain technological innovations which could supply similar products or services at a considerably lower cost and with a much higher efficiency, very rapidly decline to the point of total elimination. Although such drastic changes usually constitute a tremendous hardship to those who have devoted all or a large part of their most productive life span to the acquisition and broadening of their professional knowledge and skill, they are never the less necessary in the interest of the common good and the further progress of our civilization.

Before we try to analyse the future of photography, particularly scientific photography, let us take a brief glance at the progressive evolution in this field during the last thirty years or so.

I can still remember some of the delightful Sunday afternoon walks with my parents in one of the home-town parks and the familiar figure of an old man with a peculiar box on a wooden tripod whom we met there and who is responsible for the earliest pictures in our family album. I can also remember the painful portrait sittings in the sky-lit atelier of a more advanced photographer, or the queer stiff expressions on our faces in pictures taken at home with the light of magnesium powder.

The introduction of the automobile changed our way of life by making distant places more readily accessible to everyone, and as a result the home-town park lost much of its original charm and popularity and the familiar figure of an old man with his peculiar but productive box, rapidly disappeared from view. This period also marked the birth of another new era in photography—the 35mm camera was introduced and it became immensely popular in a relatively short time. Some ingenious businessman quickly cashed in on the low cost and ease of operation of 35mm equipment and materials by employing roving photographers who snapped everybody's and anybody's pictures on any busy city street, handed out coupons and the proofs were ready for inspection within several hours. For a time, this was a very lucrative business, until a simple box camera became available at a very low price. Now, the average person could economically take their own snap-shots at locations and on oc-

*Presented at the 29th Annual Meeting of Biological Photographic Association on August 31, 1959 in Montreal, Quebec.

casions more suitable for them. Thus, the services of a photographer were again replaced by the push button of a box camera or by an automatic photomachine which takes several shots for just a few cents and stays continuously ready for service at various locations. So, the photographer is eliminated—either by the do-it-yourself, or by automation.

Within three decades, photography has developed from the wooden box-camera stage to its present-day status. Today it has countless indispensable applications in almost every science and industry as well as being a recognized art form. The world-famous Metropolitan Museum of Art in New York, for instance, recently acclaimed photography as a fine art by devoting a gallery exclusively to displays of outstanding photographs.

Due to the diversity of individual problems it became necessary to divide photography into various branches and the professional scientific photographer became a specialist in his own field. The complexity of modern photographic equipment and techniques calls for a higher educational background and a better technical aptitude.

The diversity of daily problems is often so great that special equipment and techniques must be developed and applied for optimum results. This necessitates a substantial knowledge of physics, optics, mechanics and chemistry as well as an extensive practical experience and ability to conduct experimental research.

Advancing technology must employ a much higher proportion of trained persons; the cultural and educational level of the entire nation is being raised. "It is an intellectual revolution", said Professor Gordon Brown of M.I.T. "I think the human being has to become smarter. This isn't anything to be afraid of—this is what man, intellectually, was destined to become".

Nowadays, therefore, the professional photographer is frequently a graduate from a technical school or college who must use his entire abilities to fulfill the unlimited requirements of scientific illustration. Gradually this simple trade, once practiced by the old man with a peculiar box on a wooden tripod in home-town parks, is being transformed into and recognized as a fully-fledged profession. This recognition is not yet universally accepted and it won't be until we, members of this profession, fulfill certain pre-requirements and establish sound professional standards. Meantime we must survive the transition, the birth pangs of a new era.

However, the ice has been broken in several places and initial steps have been taken in the right direction. For instance, at the Avco's plant where several ICBMs are under construction, scientific photography became a vital part of their research and production system and the scientific photographer has been recognized and officially classified as "associate scientist."

Many significant discoveries were possible because of photography; particularly where scientific and technical measurements were obtained with photo techniques, and in most cases the man behind the machines and discoveries is the photographer.

Photography, being a very interesting and pleasant pastime, easily captures the enthusiasm of a great many scientists and others and frequently develops into a passionate hobby. Photographic skill of professional standard is often achieved to such a degree, that the results might cause much embarrassment to less competent professional photographers.

Parallel to these developments there

is also a very strong trend toward automation. Inventive genius has brought out various gadgets to perform, very efficiently, numerous manual tasks and thus considerably increase the productivity of the worker. In 1919 the U.S. population was only 105 million. At that time it took 26 million workers to produce enough food, fuels and metals and make the goods this population needed. Today the U.S. has 178 million population, instead of 105 million; the consumption and standard of living is considerably higher than it was four decades ago, yet the number of production workers is virtually the same, 26 million, and they are working a much shorter week. Some inventions simplify many operations to the point where taking a photograph or a movie simply consists of placing the object on stage A, pressing button B, and receiving the ready product at slot C. This advanced degree of automation is already used for various scientific and industrial requirements where only a few years ago one or more photographers were employed, and now it is also being introduced into such highly specialized and complex branches as photomicrography, cinematography, color printing, etc.

Resourceful photographers constantly find new applications for photography in science and industry and increase its indispensability in research, communication and production. The future of photography as a product is thus well secured but our imminent concern is about the effects of automation on the future and professional status of the scientific photographer. Will it help us to prosper and advance or can our functions be performed more efficiently by some ingenious invention?

Automation might weed out the incompetent or ignorant individuals but it will never replace the creative ability and ingenuity of those whose heart and soul is in their work. Most automats will produce satisfactory results with standard material and under standard conditions; in biology, however, material and conditions are anything but standard. Recently I had an opportunity to inspect and evaluate one of the latest fully automatic camera-microscopes introduced by a leading European optical instruments manufacturer. It is a very impressive looking piece of apparatus. In some cases it will produce quite satisfactory results, particularly if compared with those of an inexperienced photomicrographer. However, the various limitations presented by the advanced degree of automation or other factors related to the compactness, neatness or ease of operation of the instrument, make it only a mediocre apparatus suitable primarily for amateur purposes. Yet, if we take also the prohibitive price of this gadget into consideration, (and it starts at almost $4000 and up,) it becomes quite obvious that no institution can afford to equip every researcher with such an expensive set-up who only occasionally wants to take a few photomicrographs. Thus, being too limited for professional use and too expensive for occasional use by amateurs, its automation or its comprehensive and streamlined design does not adequately compare with older and simpler models which, with a little more personal effort and skill, produce superior results.

On various occasions, photographers have complained to me about the working conditions and treatment they receive at their places of employment. The source of their troubles was usually the relationship they allowed to develop between them and their customer — the scientist. Relaxed manners, unprofessional attitude and too little competence destroy desirable professional respect and

prestige and create the impression that a photographer is a Jack-of-all-trades, or at least, some kind of general mechanic.

An exhaustive knowledge of professional techniques and a professional presentation of this knowledge are only basic requirements. Individuality or the so-called "personal touch" makes the difference between a mediocre product and a master-piece. Lighting and composition of every picture should be carefully studied and arranged according to the individual requirements. For effective results it may even be necessary to employ props, make-ups, or certain lighting or optical tricks to bring out required detail or subdue any obstraction parts.

To illustrate some of the possibilities I would like to present two examples from my own experience. Both cases are within the border-line between macrophotography and photomicrography where the specimens are too small for the one and too large for the other and are also characterized by some additional difficulties.

The one case called for photomicrographs of root sections. Figs. 1-4. The size and thickness of the preparations was too big for the lowest power of my micro set-up and the job had to be done using macro-stage and macro-lenses. Initial results with this particular type of material and the standard Leitz Panphot set-up for macrophotography in transmitted illumination were extremely disappointing. The color rendition resembled anything but the original specimens. Excessive exposure resulted in undesirable fogging of the heavily stained, 25 microns thick tissue, caused by prolonged blasts of light from the highly translucent lumens. CC-filters were of no help. After some trying and testing I found that diffused light from a slightly altered illumination system was just the thing to produce very satisfactory color rendition in both lumens and the tissue.

The second assignment was to take macros of whole mounts of grain embryos. Several conditions of the embryos were to be illustrated. On the whole it was an easy assignment and the regular Panphot set-up was perfectly capable to produce very satisfactory results, except for one condition—the "Black Speck". These fine grains, located within the embryo, were obstructed by the sur-

Figure 1. Root of populus tremuloides photographed with standard Leitz Panphot set-up for Macrophotography in transmitted illumination Micro Summar 24 mm, 35 cm Bellows; Pan-X; 1/125 sec. exposure.

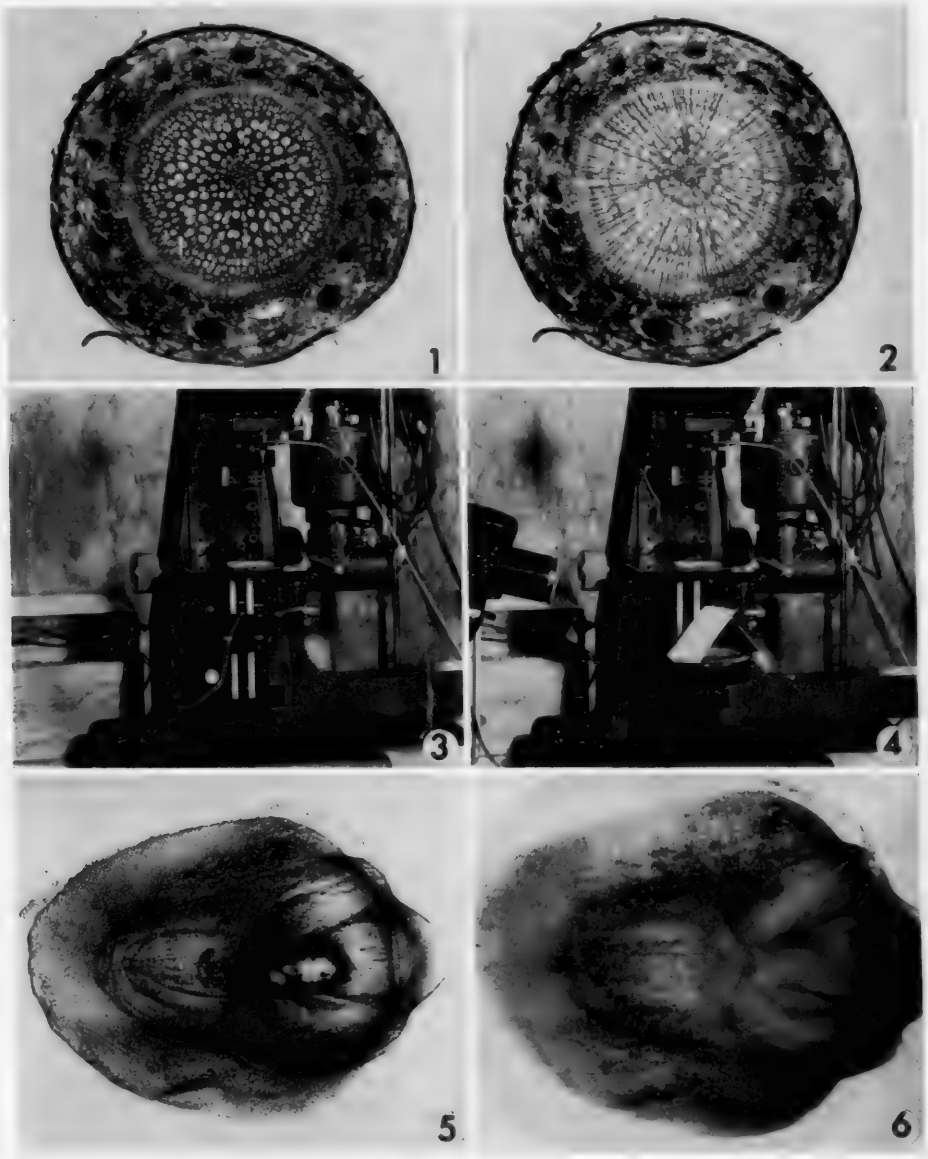
Figure 2. Same specimen as in Fig. 1, photographed with Leitz Panphot and a slightly altered illumination (see Fig. 4), Micro Summar 24 mm; 35 cm Bellow; Pan-X; 1/5 sec. exposure.

Figure 3. Standard Leitz Panphot set-up for Macrophotography as used for Fig. 1. Light passes through two substage condensers, it is very bright and focused at the object plane.

Figure 4. Altered illumination on Leitz Panphot to achieve satisfactory color rendition on color film and broader gradation of greys on b and w film. The light from an extra lamp is reflected and diffused on a white paper.

Figure 5. Whole mount of barley embryo—excessive detail—brought out by a 24 mm Leitz Micro Summar obscures a pathological condition known as Black Speck—the otherwise desired depth of focus is in this case a liability.

Figure 6. Same specimen as in Fig. 5 taken with Leitz Plano X 4; ocul. X 6. Black Speck is visible considerably better—the shallower depth of focus of this set-up proved to be an asset.



rounding tissue. Here, the macro lenses, with their otherwise desirable greater depth of focus, were a liability. The use of microscopic objectives, with a shallow focal depth, proved to be an asset. Thus, once again, the choice of a proper set-up brought the desired result, Figures 5, 6.

Poor craftsmanship and unnecessary delays are the two prime reasons for the preference which many have for automats. Automation in scientific photography does provide a challenge to the professional who until now, enjoyed a complete freedom from competitive pres-

sures, such as govern the profits of commercial photographers. Automation is also an incentive for continuous creative thinking and activity. Without this constant application, there is indeed, the possibility that the idle or inefficient photographer will be replaced by a push-button.

A new word "imagineering" describes the new process; you let your imagination soar and then engineer it down to earth. All of us are much more creative than we suspect. A true professional is first of all an expert in his job. He may or may not have scored 100 per cent in a written examination, but he does apply all his knowledge in a practical way. He puts the stamp of his spirit upon his work so that it becomes uniquely his. It has become clear to all of us that we are on the threshold of vast changes. Our profession has an unlimited future provided we use the present, wisely.

Most of us are salaried employees of large institutions and we enjoy the security of incomes which are fixed in advance. In many cases, we enjoy a considerable degree of professional freedom and the nature of our work makes close supervision or the establishment of specific hourly or daily norms impossible. Having a natural human tendency to be kind to oneself, it is not difficult, under such favourable circumstances, to fall into a perpetual state of idleness or at least laxity, or to become absorbed by matters unrelated to our actual duties. Lunch and coffee breaks have a tendency to grow in length and increase in importance; much of regular working hours will be devoted to various civic duties, organization of charitable campaigns, to various private enterprises or some pet-projects indirectly related to the job we are hired to perform. All this, of course, is done at the expense of services and production which we are expected to provide and for which we are being paid. In order to cope with the long over-due jobs we may resort to various short-cuts by sacrificing quality. Before we realize it, our work may become very poor in every respect and the time it takes us to get it done may be unreasonably long thus causing chronic dissatisfactions and grievances among our clients.

In order to provide satisfactory service as well as to protect myself from falling into a detrimental state of perpetual creative idleness or "day-dreaming", I have adopted certain principles or rules to govern all my daily activities:

1. In spite of the fact that my income is not related to the amount of work performed by me, I consider every person that enters my office as a "paying client" on whose business my livelihood depends.

2. Scientists are busy people and their valuable time must under no circumstances be wasted through unnecessary delays; proper arrangement of all the required materials and equipment and a brisk business atmosphere help considerably to limit the time needed for joint functions which is always appreciated by the scientists as well as other co-workers.

3. The best time to do any job is now. The sooner an order can be done, completed and delivered the more satisfying it will be to the customer and the more valuable our services will become. However, if the circumstances require it, an accurate appointment system can be adopted but under no condition should appointments or deadlines be postponed or delayed without a truly valid reason.

4. To avoid irritating mix-ups and to supply every necessary future reference, an effective record system, particularly in photomicrography where the subjects cannot be readily compared and identi-

fied with the finished picture, is of utmost importance.

5. Whenever professional questions are asked or some photographic condition or testing must be explained, the scientist won't be satisfied with anything but a logical and factual answer. Anyone who works in research will be sympathetic to a reasonable amount of errors or technical difficulties and will make due allowance for any necessary repetitions. We only undermine our own professionalism if we give silly excuses for serious mistakes.

6. Careful planning of every operation is absolutely necessary for efficiency and is the basis of every success. It has been proved under all conditions of human activity that people succeed best who form definite ideas of what they are going to do before they start doing it. Efficient performance of certain assignments requires the adoption of a well planned system. (In one case, for instance, we were approached to provide individual color and black-and-white macro illustrations of several thousand insects. This tremendous job progresses very efficiently because a system was worked out and adopted whereby during one morning up to 200 black-and-white or color exposures of individual insects can be taken by only one photographer and a helper.)

7. Last but not least in importance is maintaining a neat appearance, a courteous manner and spotless conditions throughout our laboratory but particularly in those areas frequented by clients. Excessive relaxing of self-discipline due to uncomfortable weather conditions or any similar excuse only contributes to the development of perpetually sloppy habits and should be avoided at all times.

In order to protect all the wonderful achievements of past and present hard-working members of our profession, to broaden our professional recognition and to determine a definite professional status, the adoption of a rigid system of certification is highly desirable. I would even suggest that this Association should consider the establishing of a Certification Commission. This Commission would work out in detail all the requirements and methods of certification based on educational standards or practical work, and an apprenticeship or internship in B.P.A.-approved establishments. I am confident that such a move would be wholeheartedly supported and the resulting certification would be fully recognized by the various scientific and industrial institutions. Such certification would establish a sound professional status and increase the importance and prestige of this Association and every individual member. Certification would also protect the interests of every bona-fide, scientific photographer by preventing this profession from falling into disrepute through the irresponsibility of incompetent individuals who misrepresent their capabilities in order to make a fast buck on the constantly growing demand for advanced scientific and industrial photography. These people are simply exploiting an unsettled situation which it is our responsibility, as qualified professionals, to overcome.

If we do not adopt this protective attitude, jealously preserving and developing the ideals of our profession, then we too, in a sense, simply become automats. It is this extra spark, this adaptability, this prestige, this manner,—call it what you will—it is this extra concern for the job which distinguishes the true professional from the amateur or the automat.

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- Adjustable Drawing Stand.
- Projection Lamp with Integral Mirror.
- The England Finder.
- Correcting Upper Sprocket Jerk.
- Portable Exhibition Panels.
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Fluorescence Photomicrography of Acridine Orange-Stained Exfoliative Cytologic Preparations

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Walter Reed General Hospital, Walter Reed Army Medical Center, Washington 12, D. C. (Master Sergeant, U. S. Army — Retired)

THE use of the Acridine Orange Fluorescence Microscopy technique in cancer detection screening is rapidly gaining wide acceptance. Several recent articles on the subject[1-5] have stimulated interest in this technique. The need for photomicrographs as documentation and illustration of scientific papers and as instructional aids prompts the author to present a photomicrographic method developed while preparing study and exhibit material and illustrations for a paper.[5]

Equipment

All types of fluorescence microscopy equipment would appear to be suitable. Our personal use of certain items must not be construed as a special endorsement of a manufacturer's product. The less powerful and less expensive mercury vapor light sources, available commercially or hand made as reported by LeCover,[4] are more satisfactory and desirable for screening and are satisfactory for photomicrography if an increased exposure time is used.

The more powerful mercury vapor light sources, such as those used for fluorescein antibody work, were used with 4 mm. of BG-12 primary and Eastman Kodak Co. Wratten G No. 15 lacquered gelatin barrier filtration, with equivalent results.

All photomicrographs were taken on a microscope equipped with achromatic objectives, standard substage condenser, ⅓ X camera attachment and a 35 mm. camera back. Ektachrome F (EKCO) 35 mm. film was used for transparencies and New Plus X (EKCO) for black and white.

Methods

Using *only* the filters described, and with substage condenser fully raised and the iris diaphragm wide open, exposures were made at high dry (500X) magnification. The low power (125X) is only satisfactory for general cellular pattern. Exposures were made in a range of 20 to 60 seconds and it was found that there is a 15 second latitude within which exposures are satisfactory.

Exposure time is based upon the intensity of fluorescence, cell types and arrangement, and background density (Table I). The exposure time for black

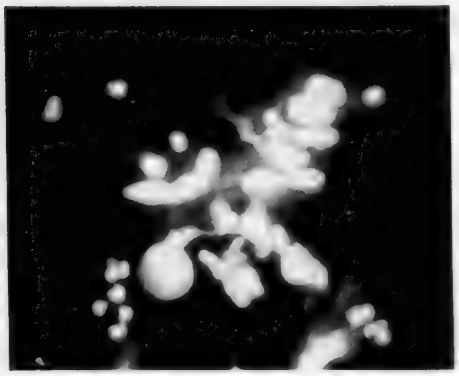

Figure 1. Highly suspicious cells from a cervical smear. Reduced from (600X)

and white photography, using New Plus X (EKCO), is one-fourth that of color. A photomicrograph of highly suspicious cells from a cervical smear illustrates the results obtained (Fig. 1).

Conclusions

Excellent color and black and white photomicrographs of Acridine Orange-stained cytologic preparations, using basic photomicrographic equipment, are attainable with relative ease without extensive training or experience.

Summary

Acridine Orange Fluorescence Microscopy applied to cancer detection screening is rapidly gaining wide acceptance. A simple photomicrographic technique which produces excellent results is presented.

ACKNOWLEDGEMENT

The author wishes to gratefully acknowledge the basic photographic indoctrination and many helpful suggestions given by Master Sergeant Harold E. Dixon, AMEDS, Research Films Section, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington 12, D.C.

TABLE I

Exposure Guide and Subject Material

Field of Focus	Single Cells	Loose Groups	Dense Groups	Degenerated & Degenerated Enlarged
Subject Fills Field	30	30	25	35
Dense Cellular Background	35	25	25	40
Moderate Cellular Background	40	30	25	45
Sparse Cellular Background	45	35	30	55

Ektachrome F (EKCO) 35 mm. film is used, and all exposures are expressed in seconds. The subject material shows moderate fluorescence. Using this as a guide, exposure time may be increased or descreased according to fluorescence and field of focus. When New Plus X (EKCO) 35 mm. film is used, the exposure for color should be divided by four.

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An Illuminator for Observing and Photographing Precipitin Reactions in Agar

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and GEORGE P. WILSON**

Abstract

An illuminator employing a modified darkfield principle is described which has been found to be especially suited for observing and photographing the agar plate and micro-slide techniques of double diffusion precipitin analysis.

IN 1949 Ouchterlony[1] described a new technique to demonstrate heterogeneity in antigenic solutions. This technique, termed the agar plate method of double diffusion precipitin analysis or simply agar diffusion, employs the specific interactions of antigens with their respective antibodies as they diffuse towards each other through a semi-solid medium contained in a petri plate. When they meet in optimal proportions with each other, a line of precipitate is formed. Differences in initial concentration and optimal proportion zones of the individual antigens and their respective antibodies are responsible for the formation of separate lines of precipitate.

Within the past few years the agar diffusion technique has been used in several phases of immunology[2,3]. One of the problems inherent in its application is the need for an adequate means of observing and recording the results. Free-hand and camera lucida drawings have been used to record the precipitation reactions. These methods, however, are difficult to accomplish accurately and are time consuming when complex systems are involved.

Photographic methods, on the other hand, have given superior results in the ease and accuracy of recording precipitation lines. A simple method of photographing the lines is to make a contact print. This can be accomplished in the darkroom by placing a sheet of photographic paper or a lantern slide beneath the plate and exposing it with a direct overhead light. Two limiting factors in this method are the insufficient contrast to record the fainter lines and the appearance of wrinkles in the glass and agar as lines in the print. Another photographic method is the use of a camera in conjunction with oblique illumination of the agar plate. Lawson[4] has described the use of such a combination.

This paper describes an apparatus we developed and designed to observe and photograph the lines of precipitate as they are seen in the agar plate method of Ouchterlony[1] and the microslide modification of Grasset et al[5]. This apparatus utilizes the combination of a

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camera and darkfield illumination of the agar plate and was developed to overcome the inadequacies of the techniques mentioned above. It also has the advantage of being portable and relatively inexpensive to construct. This apparatus is similar in principle to the one described by Schutz[6], since it provides modified darkfield illumination. However, the source of illumination is incandescent rather than fluorescent and, as a consequence, our apparatus is smaller and simpler to construct.

Description of the Apparatus

The apparatus consists of a wooden base supporting a stainless steel and brass camera mount with a stainless steel illuminator (Figure 1). The end of the base opposite the illuminator is used for micro-film photography.

The light housing of the illuminator (Figure 2) is a cylinder five inches in

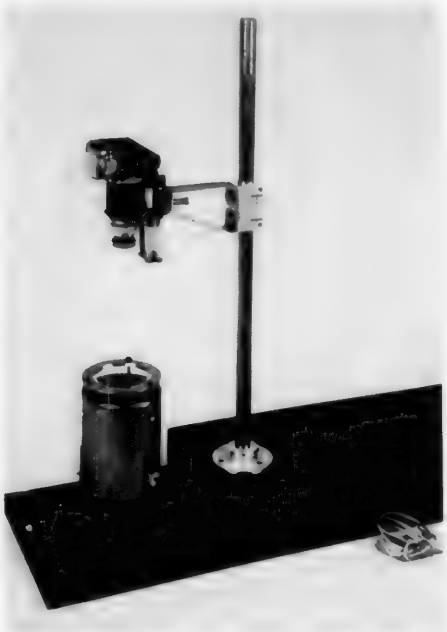

Figure 1. Camera and illuminator.

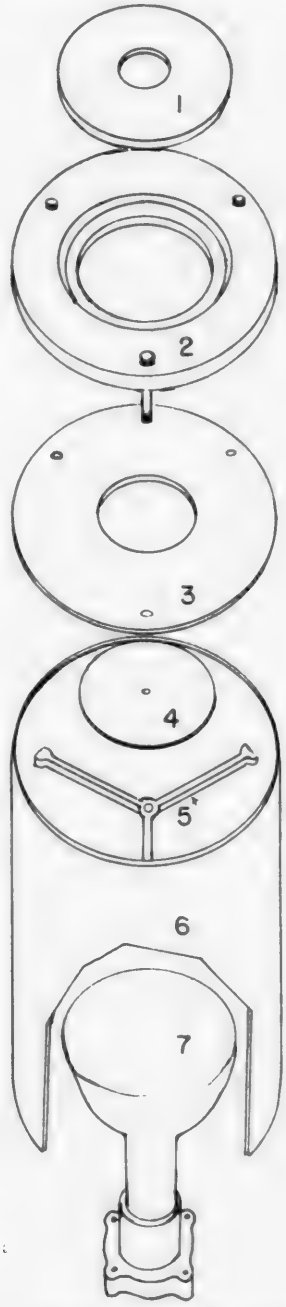

Figure 2. Exploded view of the illuminator. (1) Adapter plate for micro-slides. (2) Plate carrier. (3) End-plate. (4) Baffle. (5) Baffle mount. (6) Light housing. (7) 75W reflector bulb and socket.

diameter and seven inches long, with a plate welded on the upper end. It is lined with aluminum foil for proper cooling and light reflection. A hole 60 mm. in diameter is machined in the exact center of the end-plate. A baffle 65 mm in diameter, attached to a Y-shaped mount by an adjustable screw, is centered beneath the hole. The upper surface of this baffle is painted dull black. The plate carrier is mounted on the light housing with three adjustable machine screws. The entire light housing assembly, including the plate carrier and baffle, is centered over a 75W reflector bulb and attached to the base with three adjustable stainless steel legs.

A functional prototype of the light housing assembly was made from a tin can of approximately the same size, with the rest of the parts fashioned from sheet aluminum. This prototype was in use for two years and gave very good results.

An uncharged plate is placed on the carrier to adjust the apparatus for optimal illumination. The baffle, light housing, and plate carrier are then manipulated to obtain the smallest circle of light on the surface of the agar. The adjustments are best achieved in a darkened room.

A single lens reflex 35 mm camera with a 105 mm lens mounted on extension bellows is used for photographing the reactions in petri plates. A 50 mm lens is mounted on the extension bellows when photographing the reactions on micro-slides. Various types of black-and-white and color films have been used successfully in photographing the lines of precipitation.

Results

Through the use of this apparatus we have been able to conveniently observe and keep permanent photographic records of several thousand plates set up during the past three years (Figure 3). The photographs are free of artifacts due to wrinkles and flaws in the glass plates

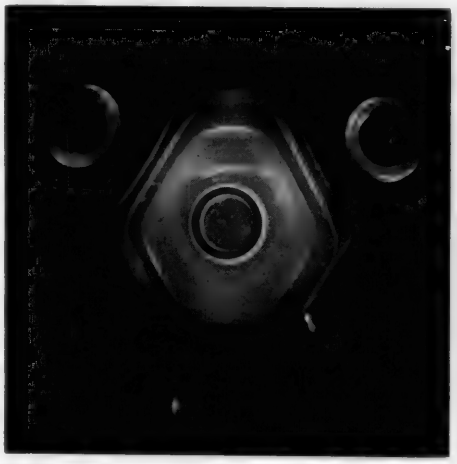

Figure 3. Photograph of an agar plate, using the illuminator described. The center well contains rabbit anti-salmon serum and the peripheral wells contain salmon sera. The three unexposed areas are due to the presence of hemoglobin in the sera.

Figure 4. Photograph of micro-slide technique, using the illuminator plus an adapter plate. The center well contains rabbit anti-salmon serum and the peripheral wells contain salmon sera.

and agar. Such artifacts were frequently encountered in records made by contact printing.

When recording results obtained from the micro-slide technique, it is necessary to place an adapter in the plate carrier and enlarge the action area (Figure 4). A contact print in this case would be too small and require viewing with a hand lens in order to see the detail.

An advantage of using a camera to record the lines of precipitate is the ease with which enlargements and duplicates can be made. With the contact print method one must know beforehand how many prints are required, since much of the detail is lost in trying to reduplicate from a print.

Summary

An illuminator which utilizes a modified darkfield principle is described. This apparatus is especially suited for the observation and photographic recording of lines of precipitation appearing in either the petri plate method, or the micro-slide modification, of the double diffusion precipitation analysis.

ACKNOWLEDGEMENTS

The authors are indebted to Miss Virginia Coleman of the Seattle Biological Laboratory, U. S. Fish and Wildlife Service, for her assistance in preparing the illustrations for this manuscript.

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Video Microscopy with Closed Circuit Television at the University of Washington[1] Health Sciences Division

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History

INTEREST in closed circuit television as an auxiliary teaching aid at the University of Washington was initiated by the faculty of the School of Dentistry. In 1951 several faculty members of the School of Dentistry utilized closed circuit television for clinical demonstration. The faculty was favorably impressed with the possibilities of the use of television, especially in those areas where a visual problem existed in the demonstration of techniques. The interest and use of closed circuit television by the dental faculty generated a similar interest among some of the faculty of the School of Medicine, Nursing, and the Basic Science Departments. With interest stimulated, the Board of Health Sciences appointed a Television Committee in 1954. Under the guidance of this committee, and the management of a television coordinator, the use of closed circuit television has increased from 8 demonstrations in 1955 to 235 teaching illustrations during the 1958-59 school year, with one complete television chain.

Equipment

In establishing a broad program for the use of the equipment, the Television Committee was faced with deciding whether the equipment should be a fixed or mobile installation. Because of the variety of uses which the equipment would have in various departments, it was decided to keep it mobile. It is the general opinion that the mobility of the equipment is largely responsible for the volume of use that we have experienced.

The equipment (Fig. 1), with controls on the camera, is operated by one person. Completely mobile equipment eliminated the need for a central studio and an expensive fixed installation. It has been our experience that students gain more from a demonstration when it is conducted in the laboratory or classroom, in which they are present, than from a remote studio with two-way communication. In our particular circumstances, a permanent studio probably would have been a deterrent to the volume usage of the equipment.

Camera Chain

The camera purchased on a permanent basis was a Dage 320 standard broadcast television chain with the gain, pedestal, blanking and target controls mounted on the back of the camera. There were important advantages to be

[1] Presented before the 29th Annual Meeting of the Biological Photographic Association, Montreal, Province of Quebec, August 31, 1959.

* Television Coordinator, Health Sciences Division and Chief Dental Photographer, School of Dentistry, University of Washington.

Figure 1. Video microscopy stand with camera positioned over microscope.

gained with the broadcast-standard equipment. The quality and stability of the picture is better: in the Medical-Dental field, this stability is imperative. Another important reason for our selection of broadcast-standard equipment is its RETMA standardization. With this standardization most manufacturers' camera chains are basically compatible: with industrial equipment this is not

true. At the present time, the Health Sciences Division has purchased another complete 320 Dage television chain.

Monitors

Twenty-one inch video monitors, in place of radio frequency television receivers, were selected for student viewing. Ten such monitors are now in use.

Use and Experience

Since the television facilities are available for use by the entire Health Sciences Division, they have been utilized for a wide variety of applications. They have been used to televise psychiatric interviews, pediatric parent interviews and post-natal examinations, physiology animal studies, general surgery, public health demonstrations, nursing illustrations, and teaching and technical demonstrations for every department in the School of Dentistry. During the past year the Histology section of the Anatomy Department in Medicine and the Oral Pathology Department in Dentistry have used the equipment on an experimental basis for black and white videomicroscopy. It is this application on which this report is based.

The departments concerned felt a need for the general showing and discussion of a few tissue slides, pertinent to the day's lecture material, at the beginning of a three hour laboratory period. With 80 to 100 students in the laboratory, it was decided to use four 21" monitors for the showing of three slides each session over closed circuit television. The televised picture had to be more than just a sharp image, at different magnifications, through the microscope. Utilizing only one camera we wanted to be able to show illustrations from a book, a tissue slide in the instructor's hand, or the instructor drawing a picture of a specific cell. Along with these other uses, we wanted to have four magnifications through the microscope: very low, low, medium, and high.

The microscope adapted for use with the television camera was the Leitz Ortholux. It has the advantage of built-in illuminator and a focusing stage rather than focusing objectives. The objectives used at different times in a quadruple revolving nosepiece were 1X (Zeiss), 2.5X (Zeiss), 4X plano (Leitz), 10X plano (Leitz), 40X plano (Leitz), 100X plano-apo (Leitz). The ocular used was a combination made from the lower element of a Leitz 6X *Periplan* and a 16 mm projection lens, both fitted to a barrel with threads for adjustment. A fine hair was attached inside of the lower element to act as a fixed pointer for the low to medium magnifications. Adjusting the spacing of the elements in the ocular brought the image to focus at the correct diameter and distance for the videcon tube. With the adjustment of the ocular itself it is possible to keep objectives almost par-focal. The modification of the ocular, the only change in the optical system, was done by Dr. Wayne Thornberg, Assistant Professor in the Anatomy Department of the University of Washington School of Medicine.

During the demonstrations we used some standard photographic oculars and Homals, but found that with the camera mounting we were using, which placed the videcon tube 4½" from the ocular, the image was projected too large for the size of the videcon tube.

The placement of the television camera is horizontal on an 18" vertical adjustable column. The tripod plate attached to the camera base allows horizontal movement. Photographic lenses are not used with the microscope, and are removed from

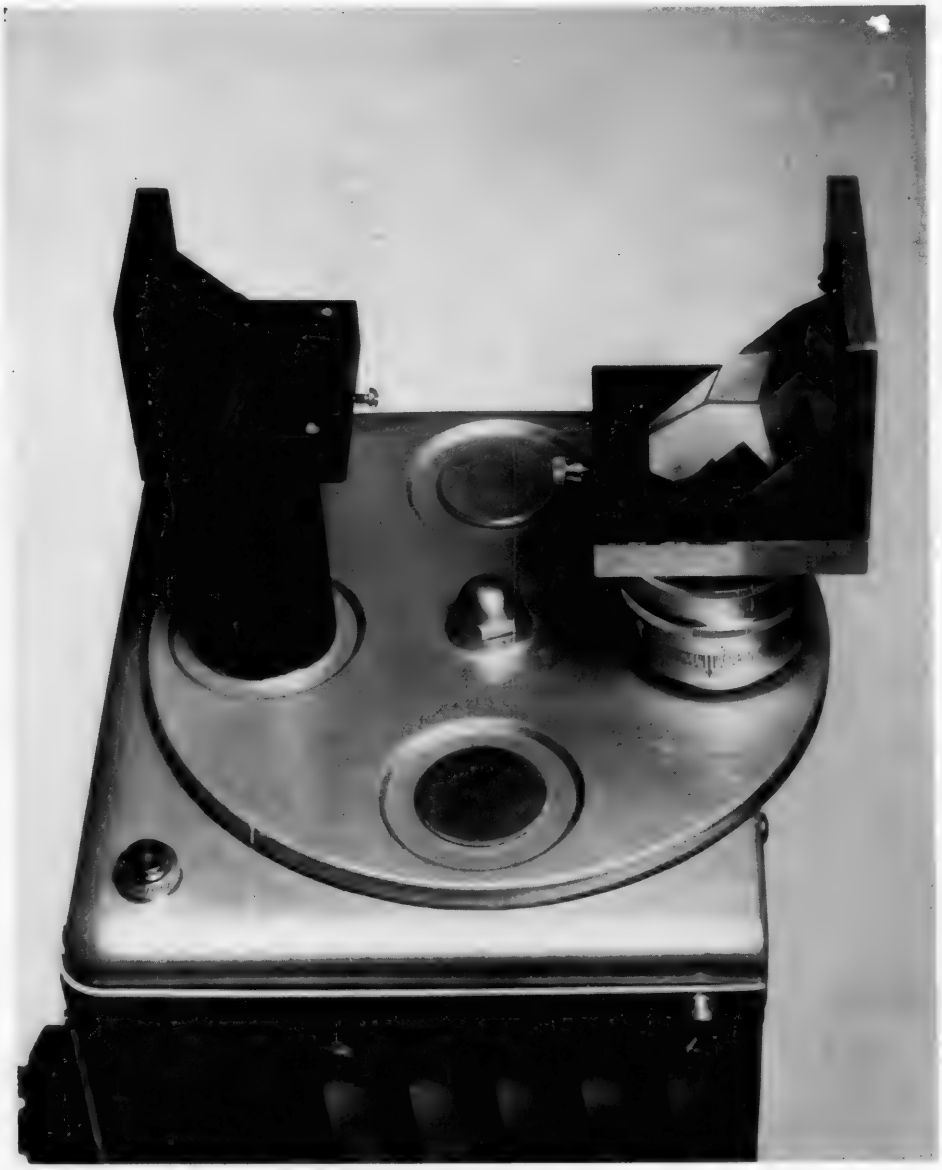

Figure 2. Camera turret showing two-inch lens with double-acting prism (upper) and 45 degree prism and tube (lower) attached.

the camera turret, with the exception of a 2″ lens used for viewing illustrations. It is necessary to mount a 1¼″ prism on a shelf at the end of a 3″ tube that is screwed into the turret, because the camera is mounted horizontally (Fig. 2). This allows the image to be projected from the ocular to the face of the vidicon tube. With the tube and prism attached to the lens turret, the microscope is moved to a position directly under the prism. The camera height is adjusted to allow ⅛″ clearance between the prism mount and the top of the ocular. The microscope is used in the conventional way, with the exception that the image is transmitted to the television monitor for viewing. With the television equipment adjusted for 600 lines of resolution the image quality is good.

It must be kept in mind that although the television picture is black and white, each student has his own microscope with a similar slide to view. Student reactions to this type of instruction has been very favorable. They have remarked, "The television gives us an instructor right at our side." It assures them that what the instructor is viewing and discussing is what they see with their own microscopes.

We have discussed the television camera's adaptation to the microscope; viewing an illustration or drawing with this same equipment is quite simple. The camera is swung to the side away from

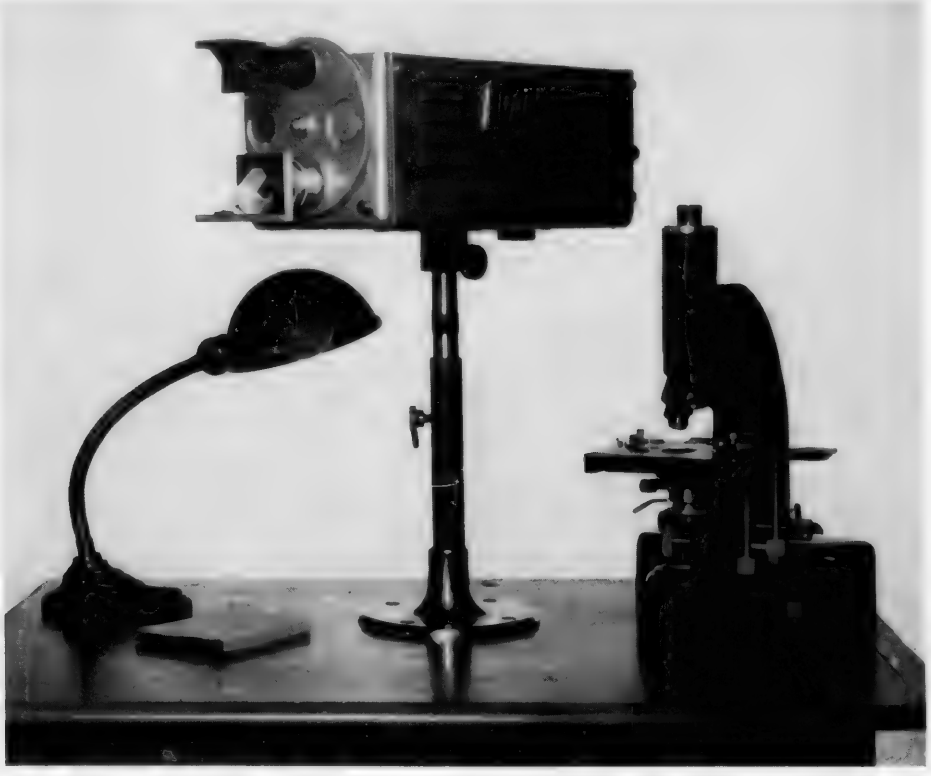

Figure 3. Camera in position to televise drawings or other illustration material.

the microscope. The camera turret is rotated 180 degrees to the 2″ lens that was left in place (Fig. 3). A double-acting 2″ prism is attached to the 2″ lens' rim, similar to a sunshade (Fig. 2). The four inch by six inch field directly below the prism is now picked up in correct viewing relationship. With the camera left in this position any illustration or object may be shown within the four inch by six inch field. A 150 watt bulb in a goose neck desk lamp is placed just under the camera lens for illumination, which is adequate. When the 2″ camera lens is in focus, and the microscope image is adjusted and in focus, the time delay in switching from one type of picture to another is only the time spent in rotating the turret and turning the camera to whichever area is to be televised.

All of the equipment is mounted on a mobile table to facilitate its use in more than one area.

During the spring quarter of this year the equipment was used for 14 class demonstrations. Indications from faculty and students alike will probably result in a greater number of demonstrations during the coming term.

THIRD INTERNATIONAL CONFERENCE ON MEDICAL ELECTRONICS

The Third International Conference on Medical Electronics will be held in London, July 21-27, 1960. The meeting is being organized by the Electronics and Communications Section of the Institution of Electrical Engineers and the International Federation for Medical Electronics. The Conference will include an equipment exhibit at Olympia.

At the Second International Conference on Medical Electronics held in Paris, June 1959, an International Federation for Medical Electronics was organized. The meeting was truly international in scope with over 450 persons in attendance from 22 countries. At the conference, Executive Committee Officers elected for the International Federation included V. K. Zworykin, Rockefeller Institute, President; C. N. Smyth, University Hospital, Vice President; M. Marchal, Ecole des Hautes Etudes, Vice President; A. M. Monnier, Sorbonne, Vice President; A. Remond, Centre National de la Recherche Scientifique, Secretary General; B. Shackel, E.M.I. Electronics Ltd., Treasurer; C. Berkley, Rockefeller Institute; W. J. Perkins, National Institute for Medical Research; R. C. G. Williams, I.E.E., members of the Executive Council.

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An Integrated Method of Preserving And Photographing Gross Specimens*

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TODAY, with more and more medical meetings of all kinds, holding staff interest and keeping up attendance at hospital conferences is increasingly difficult. We have found that one excellent stimulant is the free use of color slides of gross specimens. Verbal descriptions may not only lead to misunderstandings but are often boring and sleep-producing. (Fig. 1)

On the other hand, color slides of carefully arranged and photographed specimens accelerate the tempo of conferences, while giving more information than just a description. Even hand to hand passing of fixed specimens is unsatisfactory. Not only do they slow up the meeting unnecessarily, but those in the audience lose the thread of the discussor's thought, at the same time that they are trying to make head or tail out of what usually looks more like an old piece of shoe leather than like the tissues of the human body as they are encountered by the physicians.

Satisfactory substitution of slides for either of these other two methods means a sharp rise in the number of specimens to be photographed. This led us to develop a system integrating: preservation of specimens, gross examination, discussion by one of the staff pathologists at regularly scheduled teaching conferences, and, of course, photography. As a result, the number of color slides of gross specimens taken per year has risen from 600 in 1954 to 5000 in 1960.

The results of this system have been gratifying. The medical staff now expects to hear and *see* the results of pathology examinations. Gross specimens pictures are used constantly in the various medical conferences such as Staff, Mortality, Clinico-Pathology, Neuropathology, and Color Transparencies.*

Heretofore, the gross specimens were

Figure 1. Verbal descriptions, by themselves, may become boring and soporific.

* Presented in part at the Biological Photographic Association Convention in Montreal 1959.

* This conference is designed to teach residents, with emphasis on correlation of clinical and gross autopsy findings. It also familiarizes them with "unknown" color transparencies, now used as part of the examination for certification by the American Board of Pathology.

Figure 2. An unscheduled visit of the hurried pathologist to the photographic department.

either brought to the photographic department by the pathologist or the photographer went to the pathology department. (Fig. 2) These visits are time-wasting, not only for the photographer, but also for the pathologist, who consequently limits photography to a few specimens of special interest to him. The harried and hurried pathologist will often tend to skip photography of specimens having only general interest, or perhaps special interest to another staff member.

From twelve to twenty-four gross specimens were photographed each week under the old method. Now, about 100 specimens are photographed each week during the Gross Autopsy Review Conferences. The quantity of pictures taken is continually increasing.

Preservation

Immediately following the removal of organs from the body, the prosector dissects them in order to present the surface which is of special interest. Any skimping on the ratio of fluid to tissue results in serious deterioration in color. Therefore, all unnecessary tissue is trimmed off. Only sufficiently representative portions of each organ are saved (i.e. a $\frac{1}{2}$ to $\frac{3}{4}$ inch slice of liver, $\frac{1}{2}$ of each lung and each kidney, $\frac{1}{2}$ of the spleen,

Figure 3.

Water	20,000 cc.
Sodium Chloride	90 gms.
Sodium Bicarbonate	162 gms.
Sodium Sulfate (desiccated)	200 gms.
Chloral Hydrate	360 gms.
Raw Formalin	400 cc.

etc.). After a quick rinse in water to remove excess blood, they are placed in large buckets containing about 5 gallons of the preserving fluid. For want of a better name, we call it a "Modified Jore's Solution". (Fig. 3) When whole brains or specimens which contain a dangerous infection (i.e. T.B. of lung) are to be preserved, then the formalin can be increased from the 2% used to 10% by adding 1600 cc. of 100% formalin (40% formaldehyde) to 20,000 cc. of the Modified Jores Solution. After 24 to 36 hours the specimens are placed in smaller buckets with equal quantities or more of fresh preserving fluid and covered with wet towels, paper or cloth. Gross Autopsy Conference takes place about one to two weeks later, and the preserving fluid will keep the natural color during this time. At the same time, the fixing of the specimens allows good examination by the pathologist and clean handling for the photographer. The specimens can be blotted with paper towels leaving enough to liven but not obscure the picture.

The color begins to fade gradually after about four weeks, and after about six months, the specimens resemble those fixed in regular 10% formalin. One word of caution—the rate of penetration of the formula given is very slow. Therefore, any extensive recutting or deep dissection will usually expose tissues which autolyzed before fixative reached them. For the same reason, additional section for histology must be "shaved"

off parallel to the surface by the pathologist.

The Photographic Setup

It is almost necessary to use 35 mm. color film because of the large number of photographs. We consider Kodachrome best for recording fine detail and color fidelity. The material cost (including processing) of a 2 x 2 color slide is about fifteen cents. The larger color slides cost about $1.50 each—10 times more expensive . . . an important factor when large quantities of slides are anticipated! Also, the additional weight, the necessity of binding, the increased size for transporting and filing the larger slides add to our conviction that the 2 x 2 color slides are the more practical. (Fig. 4)

Figure 4. Slide binding is not only time consuming but tedious work.

To eliminate troublesome parallax and to simplify camera action, a single lens reflex camera is used. (Fig. 5) With a 105 mm. lens the working distances are convenient for the majority of gross specimens, and with the addition of the standard 50 mm. lens, a range of specimens can be handled from complete abnominal viscerations to small coronary arteries. The 105 mm. lens and the 50 mm. lens are used in conjunction with a calibrated bellows which gives the exposure factors due to the additional film to lens distance on close-ups. The two lenses form a desirable combination since with them specimens varying greatly in size are conveniently photographed.

The camera is attached to a Solar copying stand allowing the camera to be easily moved up and down on the vertical standard. (Fig. 6) The complete setup is attached to a table with wheels so that it can be moved readily to the gross conference.

The specimen box is of normal construction except for use of black velvet for black backgrounds. Colored paper is stored under the black velvet when it is necessary to use a background other than black. Black backgrounds are used 95% of the time, eliminating the problem of shadows and vividly colored backgrounds which in recent years have dominated gross specimen photography. Neutral colored backgrounds, while as desirable as black, would necessitate the balancing of the shadows. Every effort should be made to keep the specimen the keynote in the picture.

Figure 5. Camera setup includes a single lens reflex camera, standard 50mm lens, a 105mm lens and a calibrated bellows.

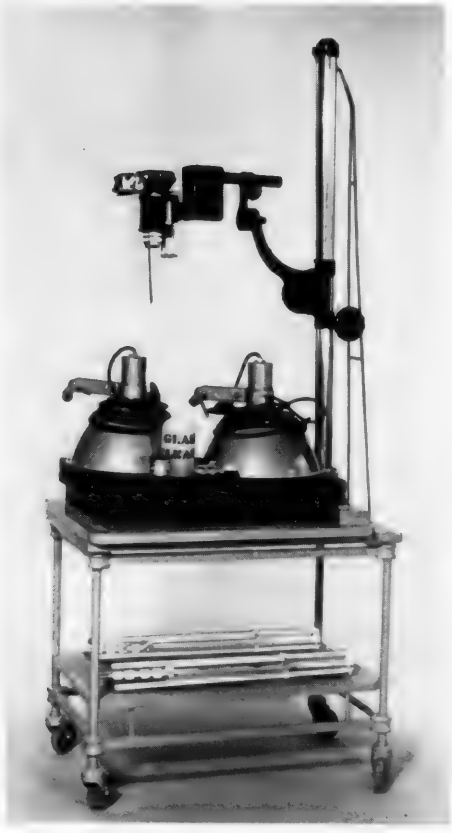

Figure 6. All the necessary equipment is assembled on a portable stand which is transported easily to the Gross Autopsy Conference.

Examination and Photographic Technique

Before conference time the cases are washed free of the preserving fluid.

Since a large quantity of rolls are sent out by our department, they must be numbered for proper identification. We photograph a slip which contains the number, date, and name of our hospital on the first exposure so that it more than completely fills the framed image (Fig. 7) This allows the processing plant to center the specimens in each following frame. If this were not done, some problem would be encountered in using black backgrounds and centering the picture.

During the Gross Organ Review Conference, the pathological examination and photography are carried on almost simultaneously. (Fig. 8)

When the pathologist has a specimen to be photographed, he gives it to the photographer and outlines with his finger or an instrument the area he wants photographed. At this time the photographer fills out a "photo" slip which contains all essential information he needs for identifying the slides when returned from the processing plant. (Fig. 9)

After receiving the specimen, the photographer blots it to remove undesirable moisture. He then places the specimen on the specimen box (preventing smearing of the glass) and orients the specimen as if he were facing the patient in an erect position.

Specimens can be arranged in other than normal positions when the proportions of the film make it more desirable to do so.

A black ruler with an appropriate length centimeter scale is placed on the lower portions of the picture.

Two photoflood lights in reflectors are used to illuminate the specimens taking care that the points of interest are well delineated. (Fig. 10) Lights, in general, are "feathered" much the same as a portrait photographer does.

The exposure increase due to bellows extension and the exposure increase or decrease due to specimen reflectance is carried out separately. This point is very important since time to compute the proper exposure is reduced considerably. We use one set light intensity for normal subjects. This is easily obtained by feathering and positioning the lights. This light intensity reads a minus 32 on the Norwood light meter and amounts to a basic exposure $\frac{1}{2}$ sec. at F 16 on

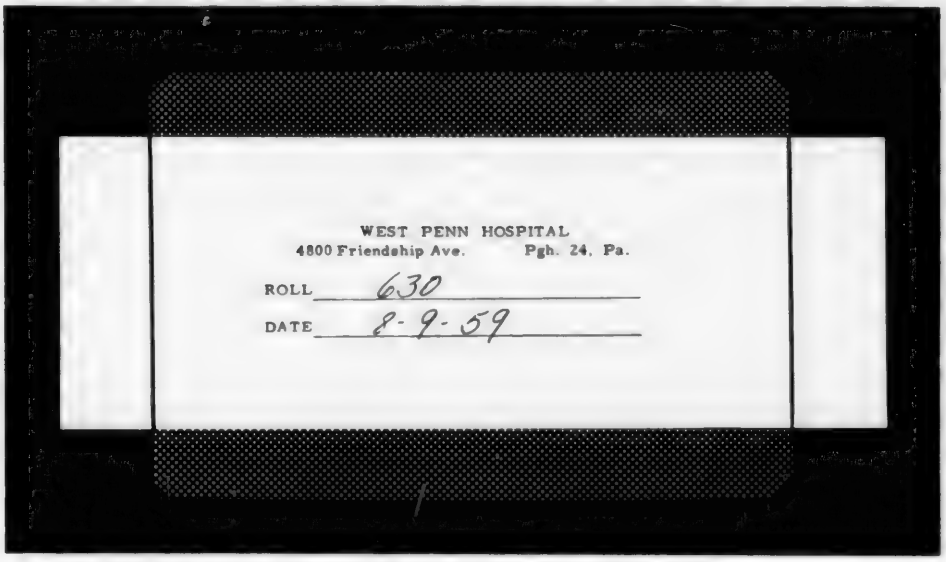

Figure 7. A roll identification slip is photographed on the first exposure of each roll. The slip should exceed the long dimensions of the framed image.

Figure 8. The photography is done during the Gross Organ Review Conference.

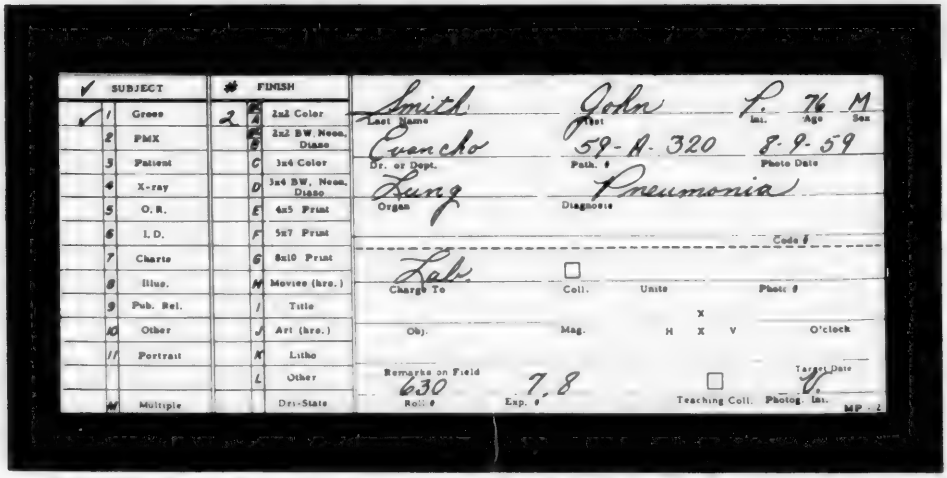

Figure 9. The "photo" slip contains all essential medical information, roll number, exposure number, and the photographer's initials.

Figure 10. The setup allows the specimen, camera, and other necessary equipment to be used at convenient heights.

Kodachrome Type A film before any exposure factors are considered. If the specimen is dark or light, the illumination is raised or lowered as necessary.

The second exposure factor due to bellows extension is compensated for by opening up the lens from the basic F 16. The required increase is engraved on the bellows rack for the two lenses used (105 mm. and the 50 mm.). (Fig. 11, 12) This eliminates combining the exposure factors due to bellows extension and specimen reflectance.

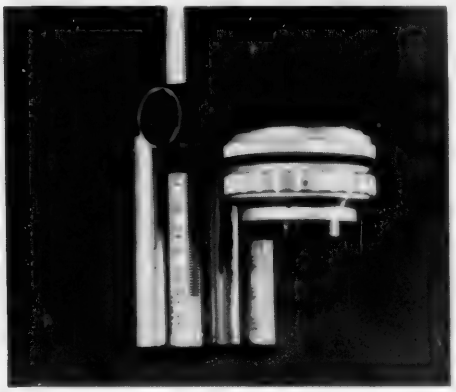

Figure 11. The exposure increase is engraved on the rack for each lens that is used.

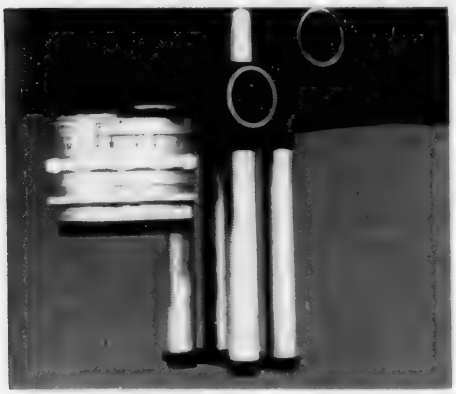

Figure 12. The exposure increase is engraved on the rack for each lens that is used.

After the specimen is photographed, it is returned to the pathologist for further examination and final disposition.

Conclusions

The examination, photography, and pathological examinations are carried on simultaneously and without undue interruptions. The combination of the Gross Organ Review Conference with the photography of the organs allows maximum conservation of time since the final gross descriptions and dissections are done almost simultaneously with the photography. This is a substantial improvement over methods which require the pathologist or his assistant to make special trips to our department with the specimens to be photographed. We go to the job. (Fig. 13) They don't come to us. The equipment is portable requiring only a few minutes to set up in a small space which can be less than 5′ x 10′. Without undue pressure we can take 20 pictures an hour or one every 3 minutes.

Figure 13. Now to make another group of "outstanding" gross specimen pictures!

ACKNOWLEDGEMENTS

I wish to thank Mr. Howard Sweitzer of the Medical Photography Department for doing the excellent cartoons. I am also indebted to Dr. Richard G. McManus, Director of the Department of Pathology, not only for the assistance in preparing this paper, but also for his interest in and encouragement of photography, which made the paper possible.

Biological Photographic Association Annual Meeting, 1960

The 30th Annual Scientific Meeting of the B.P.A. is planned for August 23-26, 1960. For the first time this meeting will be held in the Intermountain West. The hosting Intermountain Chapter is planning the event to be remembered for a real Western good time as well as a highly successful informative meeting of a wide range of biological interest. In as much as it is planned as a "family affair" many will drive and should especially appreciate that the headquarters will be for the first time in a modern motor lodge. Having air conditioning and a free swimming pool as well as being within walking distance of the sightseeing and downtown shopping areas should make it appeal to all as an ideal meeting place. A real western barbecue will open the "get acquainted festivities" on the first evening. A request by many has been met with the scheduling of a short concert by the famous tabernacle choir on another night. One day will be spent on the University of Utah campus for workshops and demonstrations and the Official Luncheon in the Panorama Room overlooking the Great Salt Lake Valley.

Salt Lake's location at the "Crossroads of the West" provides interesting traveling in any direction. Its range of elevations of eleven thousand feet makes possible a paradise for sightseers and scientists alike. Naturalists will recognize 3500 species of flora ranging from those of the Mexican desert to Arctic tundra. Only short side trips are necessary to see Yellowstone and Grand Teton National Parks or Bryce Canyon and Zion National Parks.

Plan to attend the "30th Annual" for a good time and a good meeting.

Take a Break — See Salt Lake.

Journal of the Biological Photographic Association Vol. 28, No. 1 February, 1960

The Increasing Responsibility of The Biological Photographer

J. ROBERT DANT

Chief, Medical Illustration Service,
Veterans Administration Hospital, Augusta, Georgia

THE purpose of this paper is not to emphasize the importance of Biological Photography which is self-evident to all individuals who have come in contact with this specialty. Nor is it my purpose to cover the problems of other than the medical aspects of Biological Photography. It is my conviction that all of the various specialties of the B.P.A. have problems and responsibilities equal on all planes.

In many institutions medical photography may be an individual operation in a pathology laboratory, surgical service, or one of the many other services in a hospital or medical school. The person performing this service may be primarily a medical technician, a physician, or one of many categories performing photographic duties as a supplement to his regular specialty. He may be the Chief of a Photographic Section, under a medical artist, or he may be the Chief of Medical Illustration Service and supervise the medical artist. In some universities he is given faculty rank.

Within the Veterans Administration the Chief, Medical Illustration Service, may be either an artist or a photographer. The size of these services range from one individual to as many as ten. The Chief of the Service is given more stature and responsibilities than his counterpart in many other installations. He could be compared to the Chairman of a Department within a University. This is meant only as an organizational comparison and not as equal in importance or value. He is responsible for an organizational element within the hospital. He regularly attends the Manager's staff conferences. He, in many instances, attends meetings of the Research Committee. This Committee controls all research in the hospital. The purpose for his attendance at this meeting is to acquaint himself with the programs with which the Research Service is occupied at present, and that which is planned for the future. By doing this he can prepare for present and future problems which he will be called upon to resolve. He advises the various individuals as to the aid he can supply in the audio-visual field.

Administratively he is responsible to the Director of Professional Services who is responsible to the Manager for all professional services in the hospital. He receives requests for his services from all departments and individuals in the installation. He is frequently designated as the authorizing authority for all requests made to the service.

As outlined in the Veterans Administration Organizational Manual, the functions of the service are as follows: provide medical illustration and audio and

visual aids services for the hospital; furnish consultation and advice to other services upon request; participate in hospital training programs, and participate in the medical illustration phases of research and clinical studies.

Most all Veterans Administration Medical Illustration Services are performing broad photographic and art services. In many of these they are producing photographic stills, movies, and medical art of the highest professional quality, many duties above and far beyond the photographic scope.

As a chief of an organizational element he is an administrative official and has the administrative problems inherent to all services and divisions. His position administratively brings him into constant contact with the highest authorities within the installation. He must be capable of presenting his program to these individuals. He must earn their respect as an administrator; he is not only a technician but he has a thorough knowledge of all programs in the installation relating to Research, Education, and Training. These individuals look to him for all audio-visual equipment used in the hospital for education and training purposes. This includes such items as audio-visual heart recorders, skeletons, models, sound systems, tape recorders, and all types of projection equipment. He receives the requests, budgets for, and purchases these items through the help and cooperation of the Medical Illustration Division of the Education Service, Veterans Administration Central Office. He establishes the priorities for the purchases to be made and expends the funds used by the service. These funds are controlled by himself and he obtains them through communication with Veterans Administration Central Office. This, of course, is done through the Director, Professional Services and the Manager.

He is responsible for advising all the various educators in the proper use of audio-visual material. This also includes material which is not photographic in origin. He attends classes, lectures, seminars, and conferences within the installation to help with their problems. He is the co-ordinator and advisor in many problems concerning the mentioned activities. He publishes the programs, instructional manuals, and many guides. In Augusta we have used photography, art, and offset printing to make programs, resident guide books, laboratory procedure manuals, etc.

At this installation I am responsible for the audio-visual functions for two medical conference rooms and five class rooms. When moves or changes are made I am consulted by the Instructors, Management, and Engineering Division so as to obtain optimum conditions for the use of audio-visual aids.

The Veterans Administration Hospital in Augusta is in reality two hospitals under one Management. They are referred to as Divisions. One Division is a General Medical and Surgical Hospital with a large Tuberculous patient load. The other Division is a Neuropsychiatric Hospital with General Medical, Surgical and Tuberculous patients as well as Neuropsychiatric patients. They are located approximately one and one-quarter miles apart. The total bed capacity is 1,744. The various types of patient care add to the problems of all services and divisions. This also applies to Medical Illustration.

The duties mentioned are performed in addition to having a complete photographic laboratory with all the various phases of photography that are offered in practically all other installations. The service does not have a medical artist.

The art work has been obtained on a contractual basis in the past. I firmly believe that a service can never be complete without an artist. It certainly is my wish to have this position if funds can be made available.

This installation has medical care in more major areas of patient care, other than women and children, than will probably be found in most installations. As an illustration, we have at the Forest Hills Division a Dental Clinic for General Medical and Surgical and one for the Tuberculous patients. The Lenwood Division has a Dental Clinic for the Neuropsychiatric patients and a clinic for that very special care needed for the Neuropsychiatric patient with tuberculosis. We have duplicate services in many activities. Requests have been made for photography in surgery at both Divisions at the same time.

With the ever increasing demands for medical photography, medical art and audio-visual services, the only practical answer to the problem is to have a qualified person controlling all phases of the operation. Television is one means of communication which some of you are using and most of us will be using in the near future. The photographic director of today's commercial television is the same person that performed the duties for cinematography before the advent of television. This is also true in many instances with the television cameraman.

It is correct to assume that far in excess of 90 per cent of all medical illustration work of tomorrow will be in the photographic, television, and video-tape field. This background certainly lends itself to qualify the individual as a Director of Medical Audio-Visual Communication which would perhaps be the title of the future Chiefs of Medical Illustration Services.

The future will see a great increase in the demand for complete services in all phases of medical illustration but with a far greater scope. It will also be in demand at more installations than we find it today. This director of tomorrow certainly should have a good photographic background. He will need training in this expanding field. He, in many instances, is comparable to the pilots of yesterday who, flying by the "seat of their pants", accomplished much for the progress of aviation. However, today he is a college graduate in most instances.

Many of the outstanding members of the B.P.A. do not have academic degrees, many have academic degrees unrelated to the services they are performing. Some do have degrees in similar backgrounds.

We all work in installations where the Chiefs of Departments and Services are individuals with Doctorate or Master degrees in most instances. Bachelor degrees are in the very small minority. Individuals without academic degrees in responsible positions are almost unheard of. It is most amazing the acceptance that the professional worker has given the individual who is performing photographic duties. He accepts him for his true value in the assistance in the services he performs. He at times is not accepted by other than the medical and para-medical profession. This is because they do not understand his true value. Education and training is the best yardstick for determining qualifications. It is not infallible as a professor of Columbia University has pointed out. He states that sometimes Universities turn out students as a die would turn out machine parts without individual initiative or creative imagination. He stated that the alert, intelligent, creative individual in many instances overcomes his lack of

academic training and gives superior performance in many varied and complex services that he performs.

We hear frequently of certification. This is a complex subject and would take quite a bit of time to discuss. I do not feel qualified to discuss it at length. I do have some rather positive opinions in some of the aspects of this problem. But more important than today, is tomorrow and those who will follow us. The present is the correct time to think and plan for the distant future. I am inclined to believe that even more important than certification is the educational background for the complete field of biological photography. Well-laid plans should be made for formal education, starting with the Humanities, Science, Photography, Art, and all aspects of the audio-visual field. It is not fantastic to assume that in the future the director of a program may have a Doctorate Degree. The medical profession, itself, would have been aghast in the middle of the 18th century at the thought that twelve to thirteen years of education and training above high school level would be necessary for requirements in a medical specialty. Florence Nightingale probably never dreamed of a Master or Doctorate degree in nursing.

Summary

It is my feeling that with the increasing scope and multiplying responsibilities added to fields in which the Biological Photographer is engaged, it will be necessary to initiate an expanded educational program for this specialty.

ROYAL PHOTOGRAPHIC SOCIETY

The Combined Colleges Bronze Medal donated by the Royal College of Surgeons of England, the Royal College of Physicians of London and the Royal College of Obstreticians and Gynaecologists will again be awarded in 1960 to any person of any nationality whether a member of the Royal Photographic Society or not for an outstanding example of photography in the service of Medicine and Surgery.

Work submitted or nominations for the award should be received by the Hon. Sec. of the Group, 16 Prince's Gate, London, S.W. 7. by the 30th September, 1960.

The combined College's Bronze Medal - the group's international and premier award has this year been made to M. Vulmière of Paris for his outstanding work in the field of photocine-endoscopic instrumentation, particularly in the application of the quarz rod light conducting principle.

The presentation of the award will be made to M. Vulmière by a senior representative of the three colleges—the Royal College of Surgeons of Engand, the Royal College of Physicians of London and the Royal College of Obstreticians and Gynaecologists at the Society's House, 16 Prince's Gate, London, S.W. 7. on Thursday, 5th May, 1960 following the Combined College's Bronze Medal Lecture.

Journal of the Biological Photographic Association Vol. 28, No. 1 February, 1960

Macrophotography with the Zeiss Attachment Camera

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THE use of the Zeiss photomicrographic camera can be extended to include a range of low power magnifications with the use of a bellows extension, a plywood frame, an Exacta lens and a suitable stage device (Fig. 1, 2).

The connection of the bellows extension sold for the Exacta camera fits loosely in the lower ring of the Zeiss focusing eye-piece and photo cell unit. A light tight seal was made by means of a flat black felt washer. The various pieces of wood, in this case 3/4" plywood, were shaped to fit the camera body tripod screw plate, and a large hole made to accommodate the rounded side of the focusing unit. The bellows unit is lined up and a hole drilled to permit a stove bolt to attach it to the tripod screw hole. The camera unit is thus secured by two stove bolts, 1 at the camera body tripod screw hole and 2 at the bellows

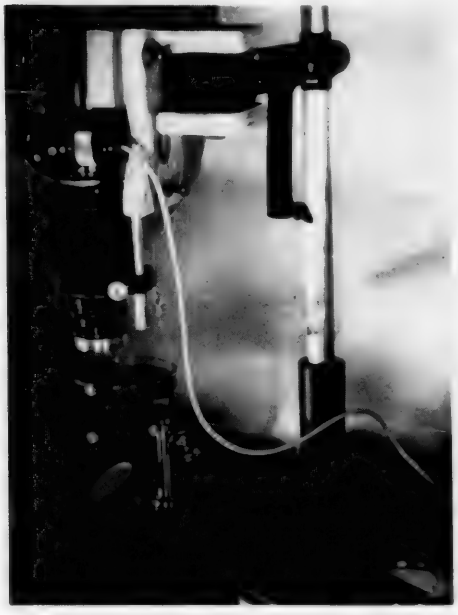

Figure 1.

Figure 2.

screw hole. The use of the Zeiss support is retained by screwing a piece of plywood at a right angle to the first number and using a large bolt to secure the unit to the orginal camera support. The use of a dissecting microscope for a support is not considered original. Miss Stella Zimmer has had one in use for years at the Syracuse University Medical School, Medical Photography Section. The use of a larger mirror helps give a greater illumination area. The ease of obtaining a basic exposure is simplified by using the Zeiss exposure unit and forsaking arithmetic and exposure formulae. An eye piece can be fitted in the upper collar of the bellows unit.

The total cost of such a unit would be only several dollars or an hour's time spent in the shop. With it the range of usefulness of the Standard Zeiss photo micrographic camera can be greatly extended.

Medical Illustrator-Photographer. Bachelor's degree and three years experience in all phases of medical illustration and photography required. Opening in medical laboratory of general hospital, St. Louis City Hospital, affiliated with Schools of Medicine of two local universities. Civil Service benefits. Department of Personnel, 235 Municipal Courts Bldg., St. Louis 3, Missouri.

Journal of the Biological Photographic Association Vol. 28, No. 1 February, 1960

An Amplifier For Microscope Photometers*

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A GOOD "do-it-yourself" (DIYS) light meter has been described[1]. Occasionally, the microphotometers employed by small laboratories, are not sensitive enough to measure light under certain conditions. For example, relatively weak light through the microscope at certain magnifications or direct readings on a ground glass are frequently beyond ordinary meter range. The parts listed in Fig. 1 were on hand in our laboratory and were used to construct a photometer amplifier, at an estimated cost of seven dollars ($7.00). The amplifier boosted the sensitivity of the DIYS meter 25 times and the sensitivity of the popular Romicron meter, 10 times, Table I. Kodachrome type F film, Leica camera and Micro Ibso attachment were used for the test shown in Table I. It should be mentioned that the photocell in our Romicron meter had

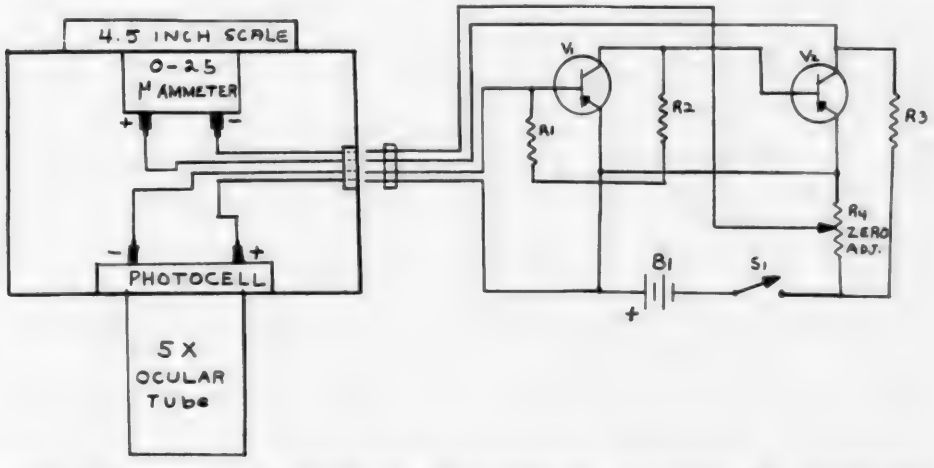


Figure 1. Circuit diagram of amplifier and meter connections. List of parts: R_1 3.9 megohms; R_2 - 1 megohm; R_3 — 22 Kohms; (all resistors 1/2 watt, 10%); R_4 — 25 Kohm potentiometer; S_1 — SPST toggle switch; B_1 — two 1.5 volt penlight cells (may be soldered into the circuit or a battery carrier may be used); Transistors, one 2N107 and one 2N34; Misc.; chassis box, control knob, Jones plug, two feet of four-lead wire, and two transistor sockets. Lead shorters for the Jones plug may be made from thin aluminum or brass strips.

* This work has been supported in part by grant B-1046 from the National Institute of Neurological Diseases and Blindness of the National Institutes of Health.

TABLE I

SECONDS OF EXPOSURE

DIYS Meter		DIYS Meter with Amplifier		Romicron Meter		Romicron with Amplifier	
Reading	Exposure	Reading	Exposure	Reading	Exposure	Reading	Exposure
1/4	12	1	50	1/4	1	1/4	10
1/2	6	2	25	1/2	1/2	1/2	4
1	3	3	16	1	1/5	1	2
2	1	6	8	2	1/10	2	1
4	1/2	12	4	4	1/25	4	1/2
8	1/5	18	3	8	1/50	10	1/5
16	1/10	25	2				

been damaged and was replaced and the sensitivity restored by glueing a B2M self-generating selenium cell ($1.47) in the photocell carrier and then simply wired into the circuit. The circuit shown in Fig. 1 consists of a generator, the photocell, the amplifier, transistors V1 and V2, a bridge circuit, consisting of a battery, B1, resistors, R3 and R4, and part of V2, and an indicator, the microammeter. A signal from the photocell is amplified by two PNP transistors which are coupled in cascade[2]. This amplified signal unbalances the bridge. This unbalance creates a potential difference across the meter causing it to indicate. When the photocell is dark, the meter should indicate zero current. If this is not the case, then R4 should be adjusted for a zero reading. When there is no need for high sensitivity, the amplifier can be separated from the meter and photocell by disconnecting the Jones plug. Contact connectors can be made that plug into the female socket and establish connections between the photocell and microammeter for normal operation.

Summary

An easily constructed electronic device is described which considerably increases the sensitivity of photocell exposure meters for photomicrography.

References

1. Machowicz, Paul and E. W. Powell. A sensitive, inexpensive light meter for photomicrography. *Science* 120:394. 1954.
2. Garner, Louis E. *Transistor Circuit Handbook*. p. 263, Pub. Coyne Electrical School, Chicago, 1956.

New Products

KODAK ANNOUNCES NEW, SMALLER MEDICAL X-RAY FILM PROCESSOR

A fully automatic x-ray processor, small enough to fit the space facilities and priced to fit the budgets of most medical x-ray departments in this country and abroad, has been announced by the Eastman Kodak Company.

The new Model M-3 X-Omat Processor, exhibited for the first time at the annual meeting of the American Roentgen Society in Cincinnati, September 22-25, has an over-all length of seven feet. It is three feet shorter than previous medical models.

In seven minutes the M-3 delivers dry film ready for interpretation. This saving of nearly an hour, as compared to conventional dry-film to dry-film hand processing, permits the early diagnosis and action that is especially important under emergency conditions.

This processor is the key to a new X-Omat Processing System which embodies a close interrelationship of film, newly improved chemicals and mechanics. Previous models of medical X-Omat processors can be easily modified to use the new chemicals, which contribute to the fast processing and drying cycle, with uniform high-quality results. Chemical solutions are automatically replenished as needed and constantly recirculated. As a result, solutions require changing only after processing of 50,000 films. For most users this means about every six months.

The loading end of the new processor extends only 18 inches into the darkroom. The remaining 66 inches of the cabinet, contain-

The new Kodak M-3 X-Omat Processor for medical x-ray films is only seven feet long, three feet shorter than earlier models.

ing the processing section, dryer and receiving bins is in an adjacent, normally-lighted room.

Exposed film from cassettes or holders is fed into the processor in the darkness. A series of precision rollers automatically conveys the film through the developer, fixer, wash and dryer and deposits it in the receiving tray, ready for immediate study.

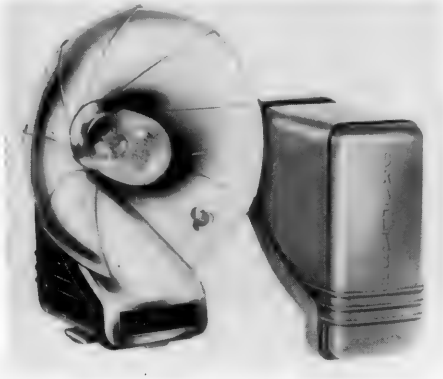
The new unit handles all listed sheet sizes of Kodak Royal Blue and Kodak Blue Brand Medical X-ray Film from 5 by 7 through 14 by 36 inches at the rate of 185 sheets of average mixed sizes per hour. Continuous lengths are processed at 40 inches per minute.

The Kodak X-Omat Processor, Model M-3, is equipped with all necessary operating accessories. Delivery is scheduled early in 1960. Further information may be obtained from Kodak X-Omat dealers or the Medical Sales Division, Eastman Kodak Company, Rochester 4, New York. List price, including installation, is $19,750, f.o.b., Rochester, New York.

MINIATURE FOLDAWAY FLASH GUN BY GRAFLEX

A truly miniature foldaway flash gun is currently being marketed by Graflex, Inc., a subsidiary of General Precision Equipment Corporation. Complete with snap-on cover, it is less than the size of a package of cigarettes, and has been designated the Graflash M Fan-Fold flash unit.

Features of the cleverly engineered folding flash gun include: An efficient three inch diameter eliptical type reflector with eight folding segments. The shiny reflector is pebbled to give soft uniform light distribution even at close range. It uses popular M5, M2 and M25 zirconium filled bulbs, incorporates built-in lamp tester and push button bulb ejector and incorporates dependable BC circuit for positive flash bulb firing and uses universal Eveready 505 battery or equivalent. The camera accessory clips and detachable flash cord mounting foot fits standard, connects to all cameras with small foreign (DIN) flash fittings. The retail price is $4.95.



Information on the vest pocket Graflash M Fan-Fold flash unit can be obtained by writing Graflex, Inc., Department 115, 3750 Monroe Avenue, Rochester, New York.

NEW DARKROOM SCALE

A new Darkroom Scale is now available in the photographic industry.

It is made in the U.S.A., and it is the only one of its kind which offers all the advantages,

at the very nominal price of $12.85. Readings are both in pounds and in grams, and fractions of same. Pounds are read in black figures, and the grams in red figures. Burke & James, Inc.

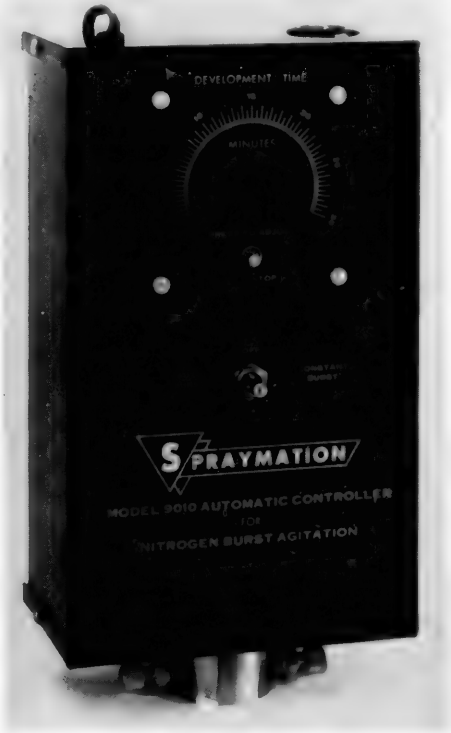
NEW CONCEPT IN CONTROL OF GAS BURST AGITATION SYSTEMS

Spraymation, Inc., 25 Amity Street, Little Falls, N.J. announce a new concept in control of gas burst agitation systems with the

introduction of their Model 9101 Controller, shown above.

This unit automatically releases bursts of gas at short, easily changed intervals, for a period of up to (30) minutes. The total development time is set on an adjustable pointer, which has a positive stop so that repetitive cycles may be set in the dark, if required. Continuous agitation or testing can be easily carried out by means of a selector switch.

A novel feature is the remote cycle indicator, which is placed outside the darkroom, and gives a continuous story as to the progress of the selected cycle. Every time there is a release of gas, a light blinks, indicating that



correct agitation is being maintained. About three minutes before the end of the period, a steady light comes on, signalling that the process will soon be over, automatically stopping the agitation. This permits the operator to leave the darkroom during development, with positive assurance that he can check on the operation of the system at any time, and be advised when it is time to return.

As a companion to this versatile controller, Spraymation, Inc. also manufacture gas distribution manifolds, regulators, gauges, control and selector valves. Complete systems are low in cost, and easily installed by the user.

Model 9101 Controller can be used with presently installed systems. Complete details available upon request. Spraymation, Inc., 25 Amity Street, Little Falls, New Jersey.

GRAFLEX INTRODUCES NEW CIRCULAR ELECTRONIC FLASH UNITS

Two new circular electronic flash units to be used with Strobomite and Stroboflash have been developed and are currently being marketed by Graflex, Inc., a subsidiary of General Precision Equipment Corporation. The new lights answer the need for a shadowless close-up light and can be used with any lens that accepts a Series VI adapter ring. The light source is fitted around the lens.

The Strobomite Circular Light Unit is designed to operate with the Strobomite Power Pack, and the Stroboflash Circular Light Unit can be used with all Stroboflash units.

The new Graflex Circular Lights have many applications in industrial, medical, dental,

police and fire photography, but are also ideal for close-up photography of small objects such as stamps, coins, insects, small machine parts for catalogs, etc.

Further information on the Strobomite or

Stroboflash Circular Light Units may be obtained from any Graflex dealer or by writing to Graflex, Inc., Dept. 114, 3750 Monroe Avenue, Rochester 3, New York.

OMAG POCKET MICROSCOPE WITH RETICLE

This compact (5½" high) and lightweight (10 oz.) OMAG Pocket Microscope with built-in illumination, can now be supplied with a

special, reticle-equipped baseplate, calibrated in thousands of an inch (0. 001").

It may be used both indoors, with plug transformer, or outdoors, with two 1.5 volt penlite batteries and is available in 3 models for different magnification ranges: 10-25x, 18-35x and 26-50x.

Designed for instant "spotchecking" by engravers, textile specialists, watchmakers, geologists, scientists, students, etc., the reticle, (which must be ordered with the microscope), permits simultaneous inspection and accurate measurement.

U. S. Distributor: Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y. The pocket microscope retails for $26.95 (OMAG 25) and $29.95 (OMAG 35 and 50), the baseplate with reticle for $19.95, the leather carrying case for $9.90.

AUTOMATIC TIMERS FOR THE ROBOT AUTOMATIC REGISTRATION CAMERA

Electronic and electro-mechanical timers available for use with the ROBOT Electro-Automatic Photo-Recording System provide exposure intervals ranging from 1/4 sec. up to 24 hrs. and permit totally unattended automatic photo registration over extended periods.

Built around the automatic ROBOT 35mm camera the ROBOT Recording System includes 30 or 200 ft. magazines, spring or electric booster motors, electro-magnetic remote releases, transformer-rectifier, etc. The timers or intervalometers eliminate manual operation and release the camera automatically at regular intervals. They all work on 110 Volt AC current and come equipped with a 3 ft. cord.

Retail prices: Electronic timer 1/4 to 60 seconds—$259.00, Electro-mechanical timer 1 to 100 min. $149.00, Electro-mechanical timer 6 min. to 24 hrs. $169.00. Specially designed timers are available on request.

U. S. Distributor: Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y., through franchised Industrial ROBOT dealers.

TELEVISION TAPE RECORDING, *by George B. Goodall, Robins Industries Corp., 36-27 Prince Street, Flushing 54, N.Y. (TE-48) Soft cover. 48 pages. Price, $1.00.*

It is an informative, easy-reading presentation of video tape recording and video playback concepts. Basic principles and basic components are described and illustrated. Control systems, special techniques, editing, splicing and duplicating of video tapes are covered. The non-mathematical and formula-free treatment of Ampex Corporation's VIDEOTAPE* machine and methods make it possible for the layman as well as the expert to gain an insight into the use of

magnetic tape recording for both video and audio applications, with emphasis on video. Frequency conversion, detection, and other sophistic procedures which make it possible to simultaneously record or reproduce audio, video and sync intelligence at conventional tape speeds, is an extension of the art of magnetic tape recording.

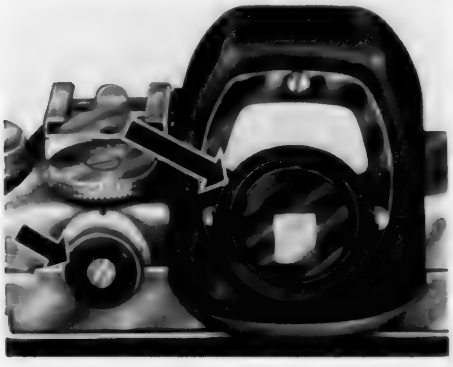
Robins' president, Herman "Hy" Post explained, "Because of the wonders of VIDEOTAPE* the book will be of tremendous popular interest. New developments in the field of magnetic tape recording will create new opportunities, new applications, and new products for the home and industry."

* Trademark of Ampex Corporation.

HEITZ DISTRIBUTES ALPA 18x24mm SINGLE FRAME CAMERA

The Swiss ALPA 35mm Single-lens Reflex camera can now be supplied for taking 18 x 24mm single frame negatives as compared to the standard 24 x 36mm double frames.

Both groundglass and film window come in exact 18 x 24mm size. The film is transported 4 instead of 8 sprocket holes and the



counter registers up to 72 instead of 36 exposures.

Especially useful for film strip production, it economically provides twice the number of exposures from the same film length.

Distributed in the U.S. by Karl Heitz, Inc., 480 Lexington Avenue, New York 17, N.Y., through franchised ALPA dealers, ALPA single frame cameras retail for $100.00 more than the standard models.

MECABLITZ 102 and 103 ELECTRONIC FLASH GUNS

The world of electronic flash gun users seems to be pretty equally divided into two

camps. Many prefer to clip a small light weight flash head to the camera and to carry the weightier part of the equipment slung from the shoulder. Others prefer having the unit all in one piece. With Mecablitz you "pays your money and you takes your choice."

The new 102 and 103 units are electrically similar but each is designed to satisfy the members of one or the other of the two camps. The 102 is the two piece unit, with the flash head weighing mere ounces. Both guns weigh approximately 2 lbs., complete with battery.

Both use the most modern double transistor circuitry. The highly efficient monitoring cir-

cuit, used on previous Mecablitz units, which conserves battery energy and which guarantees full and equal exposures from the first to the last shot, has been retained. More pictures can be taken because of the low idling current between shots. The battery is a new 6 Volt type, completely sealed, leakproof and requires very little maintenance. It is rechargeable and gives about 75 flashes per charge.

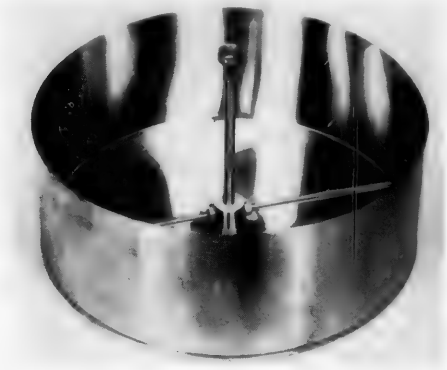
The trough type Mecablitz reflector is extremely efficient, covering 65°, permitting the use of most wide-angle, as well as normal lenses. Guide numbers for Ektachrome are 43-49, depending upon surroundings. The lamp is fitted with the now famous and exclusive Mecablitz Sunlight Converter, a device which assures a color temperature of 5500 Kelvin, ideal for color films. Recycling time is 8 seconds, flash duration 1/1000th sec.

Both of these new guns are beautifully made, of special impact-resisting plastic, in a soft gray color. Price, either model, only $59.95, complete with battery and charging unit. Burleigh Brooks Inc., 10 West 46th Street, New York 36, N.Y. At all dealers.

BROOKS OFFERS EASY TO USE NIKOR ROTO-WASH TANK

Users of the well known Nikor Processing Machines (for 16 to 89mm films) will welcome the new Roto-Wash Tank.

This device is simplicity itself to use. In practice the loaded reel is merely placed on the spindle and the water turned on. Water pressure is used to rotate the reel during washing, at about one revolution per second.



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Improving the Teaching of Radiological Anatomy Through Demonstrations Using Transparent Diazo Overlays

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THE purpose of this article is to describe a simple method of creating demonstrations of anatomic principles from x-ray films. It can be used equally well in the teaching of clinical radiology. The method itself can be used for any demonstration in which it is desired to present an unaltered photograph yet have instructional material upon an absolutely transparent overlay.

Radiological anatomy today is accepted as one of the established divisions of human morphology. Most often it is coordinated with gross anatomy just as topographic and living anatomy, kinesiology, and surgical or applied anatomy have been correlated with systematic and regional anatomy in most curricula. In a few schools the anatomy department faculty can present the principles of radiological anatomy, but in most institutions it has been found that the interdisciplinary approach brings the best results. All schools have excellent teachers of human morphology in their radiologists and, therefore, it has become customary for anatomists and radiologists to cooperate in teaching the principles of morphology by the use of radiological techniques.

Many of the readers of this article are occupying positions in which they provide technical assistance in teaching and research. It is believed that the provision of details of the method will enhance interdepartmental audiovisual cooperation whether in a Medical School, University Hospitals, or Clinics where exhibit material is prepared.

Current Techniques and Associated Problems

A variety of arrangements exists between departments of anatomy and departments of radiology to demonstrate radiological anatomy. Basic to all modes of instruction is a series of lectures in which the radiological anatomy of various body regions is presented during the progress of the course in gross anatomy, each one usually at the end of a unit of regional dissection. Lantern slides of radiographs are typically employed, for unless small sections can be arranged, illuminated radiographs lose their value beyond the first few rows of students. This instructional technique is inadequate alone and needs to be supplemented.

Where a university hospital is associated geographically with the basic science unit of a medical school it is

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possible for first year students to visit the radiology department in sections for additional, more intimate instruction in radiological anatomy. Visits of the radiologists to basic science laboratories may provide further instruction and close correlation with the gaining of knowledge from dissection. In such fortunate situations there may also be freshman orientation or correlation clinics where radiological findings are shown in their proper place in the evaluation of patients.

Many problems arise in supplementing didactic teaching of radiological anatomy when there is a geographical separation of the clinical facilities, and thus departments of radiology, from the basic science teaching building. Here it is almost impossible for the radiologists to appear regularly in the anatomy department because of the nature of their duties in serving the clinical units. There is a very real danger of inadequate or, in fact, inaccurate instruction of first year students if the anatomy staff attempts to demonstrate from a departmental file of x-rays. It must be remembered that radiological anatomy represents the first year students' primary acquaintance with the whole idea of radiology. Its fundamental basis in physics, techniques, and findings in terms of shadows and photographic densities are a new and bewildering series of concepts. These are basic and must be clarified for the student before interpretations of morphology can be made. Misconceptions must be avoided for the student seizes eagerly upon x-rays as a bit of the clinical picture which he really came to school to learn.

Most plans for supplementing didactic teaching by demonstrations of radiographs do take the form of a department of anatomy file of x-rays which have been acquired over a period of years from the radiology department or an interested clinician who teaches applied anatomy.

Many forms of visual interpretation or labeling are used in the absence of a radiologist in the laboratory. Some of these are:

1. Preparation of a diagram of the pertinent points in the form of a chart placed on an adjacent illuminator or posted near the x-ray plate.

2. Preparation of an exact scale, inked tracing which is used similarly.

3. Marking of the x-ray itself with arrows, circles, or labels with lead-in lines in white or black ink as indicated by shadow densities.

4. Preparation of some sort of an overlay to bear illustrative material which can be bound to the x-ray.

Often each of the techniques proves to have disadvantages which diminish the effectiveness of the teaching method. These are:

1. Diagrams and tracings which are placed adjacent to an unaltered radiograph result in the necessity of eye movements from one to the other. The inexperienced student may have considerable difficulty in locating the morphological feature on the x-ray itself.

2. Marking of the x-ray itself adds to the confused pattern which the beginning student sees on a radiograph. Extra lines, arrows, and labels distract the eye from the point being demonstrated. The major disadvantage is that the addition of the illustrative material alters the x-ray itself so that the student, once oriented, can neither view the patterns in their pristine form nor return later to test his newly acquired knowledge.

3. Most methods of creating overlays have had the disadvantage of obscuring the radiograph beneath to some degree. The most common material, cleared exposed x-ray film, is opaque or translucent. Although it will take india ink, marking ink, or crayon the cleared film does not permit the features of the x-ray beneath to show as clearly as desired. Other materials vary in their transparency or combine with the graphic means employed for labeling to impede clear visualization.

It is with such a background of the problems encountered in supplementing didactic instruction in radiological anatomy that the method presented in this article has been evolved. The simplicity and entire satisfaction of the resulting demonstrations seem to justify the submission of this report as both educational and exhibit methods.

The Nature of the Diazo Method of Producing Teaching Overlays

The object of this method is to produce completely transparent overlays which bear instructional material to orient the beginning student in radiological anatomy. Diagrammatic or outlined instructional material is prepared to the exact scale and precise position of the real features appearing in the x-ray. The method uses the diazo (Ozalid) duplicating process to create transparent acetate overlays in which instructional material is permanently transferred to the substance of the acetate film. No lines must be drawn upon its surface. The overlay is printed in a color (blue) which does not compete with the photographic densities of the x-ray. It is oriented exactly over the x-ray and bound to its top edge so that the outlines on the overlay coincide with the morphological features to be demonstrated. These features are readily and clearly seen through the imprinted overlay for initial orientation but yet may be lifted so that the student may view an entirely unaltered x-ray film. This may be repeated until he is satisfied that he understands. With proper labeling and titling on the overlay the unit becomes a durable, self-contained, silent demonstration. There is no shifting of the eyes back and forth, no problems of finding lost or filed charts, and the unaltered radiograph can be viewed alone and used for other purposes. The same film may also be used with different overlays to demonstrate single features from a complicated composite.

The diazo duplicating process is a common technique used widely in offices for copying purposes, for rapid quality duplication of all sorts of graphic material, and in intermediate stages of many publishing processes. It depends upon the fact that diazo dyes present in invisible form in a thin acetate film will reproduce the lines and forms of an original when exposed to intense ultraviolet light. A color, dependent upon the dye present in the film, will appear in the acetate upon further exposure in the machine to ammonia vapor, regardless of the color of ink employed on the original material. The nature of the process is not as formidable as it may appear nor is it a bar to its use. There is probably one of these machines, in daily use with personnel to operate it, already available somewhere in a medical school, its university, or the hospital. Many art and photography departments have these machines for the same process is becoming a standard way of making lantern slides, charts, and exhibit transparencies more rapidly and easily than

with other methods. If no machine is available, agencies making copies for business purposes can duplicate the illustrative material by this method.

Stages in the Production of the Overlays

1. *Selection of radiographs to use.*

The first consideration is that of conferences between the radiologists and the anatomist. If the radiologist is a full partner in the endeavor from the start cooperation will be enhanced and the quality of the demonstrations will be maintained at a high level. Teaching will be improved because the radiologist may view this opportunity as one to introduce the fundamental principles of radiology very early in the curriculum and coordinate radiological findings with dissection.

Although the radiologist knows his films and his file of cases best, joint selection conferences give the best results. It is true that the radiologist can select films for their teaching value and send them over but joint effort pays dividends. From a myriad of possible films the two departmental representatives can select the best for teaching morphology. The selection can transcend normal plates for the radiologist can bring forth x-rays obtained by special techniques that will teach anatomy in a striking manner. An upper gastrointestinal barium series that demonstrates the compression of the esophagus by an enlarged right atrium will imprint graphically thoracic relationships. A calcified interlobar pleura or an interlobar effusion presents pulmonary anatomy and its topographic implications dynamically. Angiograms, cholecystograms, retrograde and intravenous urograms, and fractures all have their place in morphology. How better can we show the internal cavitary system of the brain in relation to the living skull than by a good ventriculogram? Figure 1.

Figure 1. A typical roentgenogram photographed by transmitted light on an x-ray illuminator.

2. *Initial Preparation of illustrative material.*

Someone must work with an artist, or be an artist, although the level of artistic skill is not demanding. If either the anatomist or the radiologist has any sort of ability with a pencil and with a simple drawing pen and india ink either one could prepare the simple diagrams and labels required. If either the medical school or the hospital has an artist or technician who can do the work the result will be improved technically and the work load upon any one individual will be eased. As the anatomist and the radiologist confer, rough pencil

sketches can be made which show the outline and position of features to be shown with notations to guide labeling and titling. These would be sufficient if either of the partners will do the final drawings. If an artist is to be employed he should be brought in at this point. The selected radiographs are demonstrated on the illuminator and the features to be presented are discussed from the x-rays and the rough sketches. He will probably make his own sketches and notations particularly of size, exact position, and labeling desired. The artist must be impressed more with the necessity of exact tracings of size, position, and labeling desired, than with plans for delicacies of artistic expression.

3. *Preparation of Final Tracings.*

This is accomplished better on a flat, illuminated tracing table or a horizontal illuminator than upon a vertical box where slippage can occur. A thin white tracing paper should be used which is of the same size as the x-ray plate even if only a part of the paper bears a diagram. A special paper is made and recommended by the companies which manufacture the diazo process machines and the acetate film. This is not necessary provided that either a white tracing or lightweight layout paper is used. The determining factor is that it be light enough in weight to transmit illumination during later processing. The x-ray is placed upon the illuminated table and the paper is positioned over it. Following reference to the rough sketches, a penciled tracing in outline is made of the selected features. Shifting of the paper must be guarded against for the traced features must coincide exactly in size and position to the original radiographic shadow. The penciled outlines are then inked with india ink and the desired labels and guide lines are added. Attention should be given to composition of labeling as in any diagram for publication bearing in mind the added factor that an x-ray will be viewed through the instructional material. Areas to be emphasized may be created by the use of Zip-a-Tone, Artone, or Craftint techniques. Figure 2.

4. *Making the overlay.*

In the photographic laboratory or duplicating office, the inked tracing (now acting as a negative) is inserted into the diazo processing machine in contact with the acetate film. Moving belts convey the two together in the first stage during which intense ultraviolet light exposes the dye in the acetate film through the traced "negative" paper. The machine then separates the tracing and returns it to the technician. The exposed acetate film then is conveyed through a chamber containing ammonia vapor where the dye color becomes visible and exactly duplicates the material of the original tracing. Blue has been found to be the best color. It is clearly visible. It does not obscure the radiographic shadows nor blend with them as does black. Red, brown, and yellow do not appear clearly. In one minute the overlay is completed.

5. *Affixing the overlay.*

The finished overlay must be bound to the surface of the x-ray plate in such a way that it may be easily lifted. Double-faced, pressure sensitive transparent tape is the best binding material. Side binding is not recommended, for the acetate film may be brushed aside repeatedly as the overlay hangs on the illuminator and tend to assume a curled position. Top binding eliminates this, avoids damage to the overlay, and per-

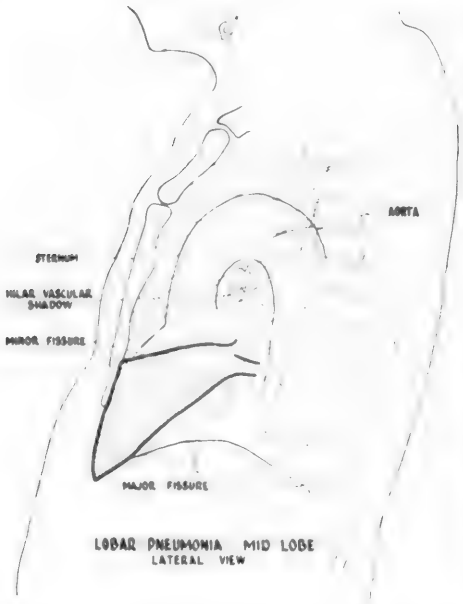

Figure 2. The inked tracing made from the same x-ray with added legends and the use of Zip-a-Tone.

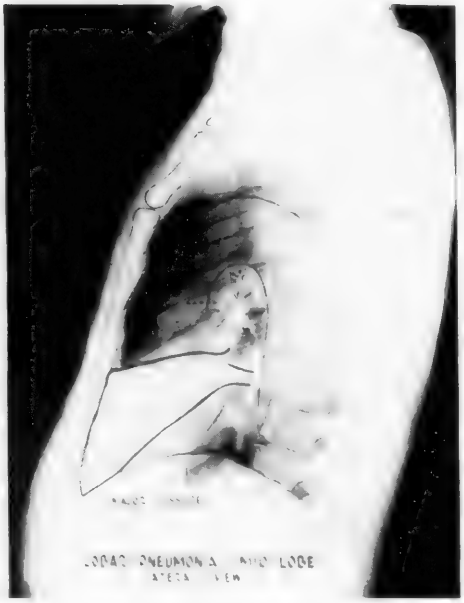

Figure 3. The finished overlay affixed to the same x-ray and by transmitted light.

mits the student to lift it easily to examine the unaltered radiograph. Again, it is important that the person who affixes and binds the overlay use a flat illuminator or tracing table to facilitate exact orientation of the acetate film in binding. The instructional material *must coincide exactly* in position with the feature beneath. Since the acetate film is obtained in the same size as the x-ray, if the original tracing was accurately made at the same scale there is only minor positioning needed. Admonitions of accuracy need not imply a complicated method for virtues of this method are its simplicity and rapidity. Figure 3.

Use of Diazo Overlays

The result of this method is a durable demonstration which is easy to file and simple to put up. The demonstration may be a silent one encouraging students to study it singly or in small groups. It is the root and stimulus of many discussions which lead directly to their study of morphology. Interpretations are accurate for the basic concept is contained in labels and titles. At this point, however, the anatomist-radiologist partnership may still be employed. These silent demonstrations will teach themselves, with a minimum of explanation from the anatomy staff, and thus surmount the geographic separation from busy radiology departments. It is recommended, however, that, after a given demonstration has been displayed for a class period, a radiologist visit the anatomy laboratory if but for an hour. Then he may engage small groups of students in brief but illuminating discussions, answer questions, or point out auxiliary features.

At the author's institution it has been found that this makes an excellent introduction to faculty responsibilities for a junior radiologist. More men can teach and this is an advantage for, except in hospital teaching, there are usually more radiologists than there is time available for their didactic efforts in the curriculum.

It is obvious that the same method can be used for the teaching of clinical radiology. The simplicity of the process makes it possible to present demonstrations of radiographs wherever illuminators are available. Silent demonstrations can extend radiologic teaching from the x-ray department to any point where undergraduate students or physicians meet or congregate and become a valuable adjunct to hospital teaching programs. Demonstrations may be set up very easily in student lounges, staff rooms, and in hospital hallways. The teaching method is as useful in teaching the fundamentals to students of nursing, physical therapy, occupational, and medical technology as it is to professional medical or dental students.

The broad applications of the diazo process are unlimited in the preparation of scientific exhibits. Wherever a photograph or photomicrograph can be mounted for transmitted illumination instructional material may be added as an overlay. Charts, graphs, or general illustrative material duplicated on the acetate film make striking illuminated exhibits in which a broad color range may be employed although the method permits the making of the original work in black and white.

Summary

Current inadequacies in the demonstration of radiological anatomy are reviewed with an emphasis upon technical problems. The use of the diazo duplicating process to create completely transparent acetate overlays which bear instructional material is suggested. The stages of production in this simple technique are described and illustrated. Suggestions for the use of these demonstrations in interdisciplinary teaching are discussed. The simplicity and broad usefulness of the process recommends it both as a teaching method and for a variety of exhibit purposes.

Acknowledgements

Development and use of this method has been the result of cooperation of many persons among whom are S. Archibald Morton, M.D., Clinical Professor and Chairman of the Department of Radiology; Leo C. Massopust, Sr., Director, and Robert Teevan of the Department of Art and Photography; and Michael Marodick of the Department of Illustration, Columbia Hospital; Stanley Weinreb, Ph.D. of the Department of Anatomy suggested the use of the diazo process.

A short article discussing the teaching application of this process will appear in a forthcoming number of the "Journal of Medical Education."

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Use of the 35mm Camera for Photographing Small Laboratory Animals

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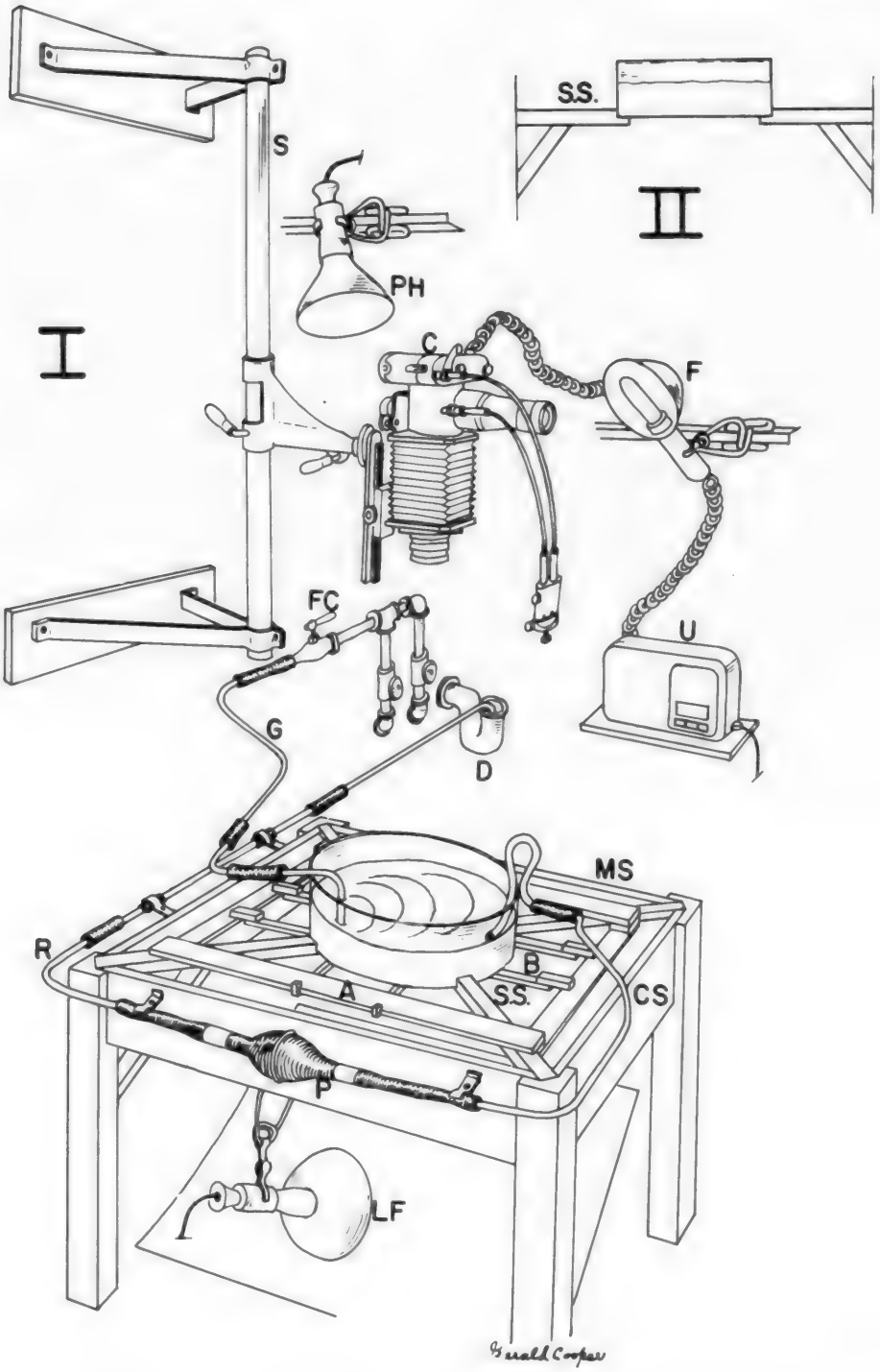
PHOTOGRAPHIC equipment that permits rapid exposures suitable for both 1:1 pictures and enlargements is valuable when photographing small animals in the experimental biology laboratory. This equipment must often be relatively inexpensive and require only a limited space. The large cameras used in our earlier work,[1] which permitted a 1:1 image on the negative (5″ x 7″), were inconvenient for our purposes and often failed to give satisfactory results. These cameras were too large, heavy, and inconvenient for use in a small laboratory. The films were comparatively expensive, and reloading the film holders was inconvenient and time-consuming. In addition, enlargement possibilities were limited. Making enlargements from the 5″ x 7″ negatives during the printing process was practical only in exceptional cases, because the apparatus needed was costly and required a great deal of space in the darkroom.

In spite of their unfavorable characteristics, large cameras are often the standard photographic equipment in most of the laboratories of the research institutions, universities, and hospitals in this country. When 35 mm cameras are mentioned they are usually considered only auxiliary equipment. For example, for photographic work in hospitals, Saren and Shapiro[2] recommended five different cameras; three of these (the most often used, according to the authors) are large (two illustrations in their article show large cameras and photoflood bulbs used to photograph a rabbit and a child), and the other two are 35 mm cameras to be "used in situations where larger equipment is not practical or necessary."

This paper reports our work showing that the 35 mm camera, with electronic flash and a special attachment for close-up photography, can be utilized as the primary equipment for macrophotography in an experimental biology laboratory.[3,4] Among the many 35 mm cameras available, relatively few accommodate special attachments for suitable close-up photography. In my experience, the best results have been obtained using a Leica M3 with bellows focusing device, Visoflex I, and Hektor 135 mm lens, because the method of focusing is convenient (Figs. 1 and 2). The Visoflex I permits easy focusing because the ground glass screen image, enlarged by the focusing magnifier, is especially brilliant and provides an accurate check on the sharpness of focus right up to the moment of exposure. By means of a twin release the reflex mirror is moved out of the optical path when the camera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Gerald Cooper

Figure 2. Some details of the installation for photographing animals from above, shown in Figure 1. PH, photoflood lamp for lighting during focusing; F, electronic flash head; FC, flash cord which connects camera with flash head; C, Leica camera body; M, mirror reflex housing; R, T, twin release connected with the release button of mirror reflex housing and with the camera release; U, unit of the electronic flash.

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Figure 1. Installation for overhead photography of animals in a glass photographic container supplied with running water. *I.* A and B, adjustable strips used to show the field covered by the camera lens; A, strips held by attached lead strip under the support; CS, support for photographic container; C, camera (Leica M-3) with bellows focusing device and mirror reflex housing; S, camera support; S.S., supporting wood beams; PH, photoflood lamp for lighting during focusing; F, electronic flash head; U, unit of the electronic flash; LF, lower photoflood lamp for lighting the white background under container support; FC, faucet of water line connected with hot and cold main water line; G, glass tube connected with water faucet as inlet to the photographic container; MS, metal pipe connected with siphon for removing water from container; P, hand rubber pump for starting the siphon; R, glass tube connecting siphon with drain for removal of water from container; D, drain. *II.* Detail showing the wood beams with end laps supporting the glass container.

shutter is operated. If both black and white and color film are to be used, it is convenient to have two camera bodies (Fig. 2C), one loaded with black and white and the other with color film. In this way either type of picture can be taken quickly without reloading.

A metal tripod with an elevator head is a good camera support for side view photographs of small living animals. I use a specially constructed wall support (Fig. 1). The main portion of this support is a Graflarger stand, manufactured for use with Graphic cameras when they are being used as enlargers. The metal base of the stand was removed, and two steel brackets attached the column to the wall.

We have found in this laboratory that four 500-watt photoflood bulbs, as a light source gave too much light between exposures and not enough during exposures. The animals were irritated by the light and heat and often could not be photographed, while the photographer found the intense light and heat tiring. Although photoflash bulbs were better in this respect, they were relatively expensive and had to be replaced after each exposure, an inconvenient and time consuming operation.

A good source of light for photography of laboratory animals is an electronic flash unit, because its high speed provides the motion-stopping capacity that is essential for satisfactory pictures of quick-moving small animals. While many types of units may be used, I have found a Braun Hobby Automatic unit satisfactory. This flash unit operates on either battery or alternating current, although alternating current is preferable for a stationary installation. The flash head can be held by hand during the exposure, but an attachment bracket fixed to the wall is desirable with a stationary installation. A flash cord at least 6 feet long provides for use of the flash head from any side (Fig. 2).

The enlargement printed from a 35 mm negative (Fig. 3), in spite of the very small size of the original, is comparable in quality with the contact print made from a 5″ x 7″ negative (Fig. 4). A comparison of these prints, both the same ratio size, shows that the 35 mm enlargement is actually better; the contours of the gills and the hind limbs are sharper, and the pattern of the skin shows more detail. An important feature of a good 35 mm negative is that enlargements of any portion can be made easily, and usually without sacrifice in quality (Figs. 5, 6).

A poor picture can often be explained

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Figure 3. Photograph of adult black axolotl *(Siredon mexicanum)* taken with Leica M-3 camera. Electronic flash, f/16, Plus-X film, enlarged to natural size.

Figure 4. Photograph of adult black axolotl *(Siredon mexicanum)* made by large camera (5 in. x 7 in.). Photoflood, f/32, contact print.

Figure 5. Close-up photograph of portion of the head of axolotl. Electronic flash, f/16, Panatomic-X film, enlargement.

Figure 6. Close-up photograph of portion of the head and gills of adult white axolotl. Electronic flash, f/16, Panatomic-X film, enlargement.

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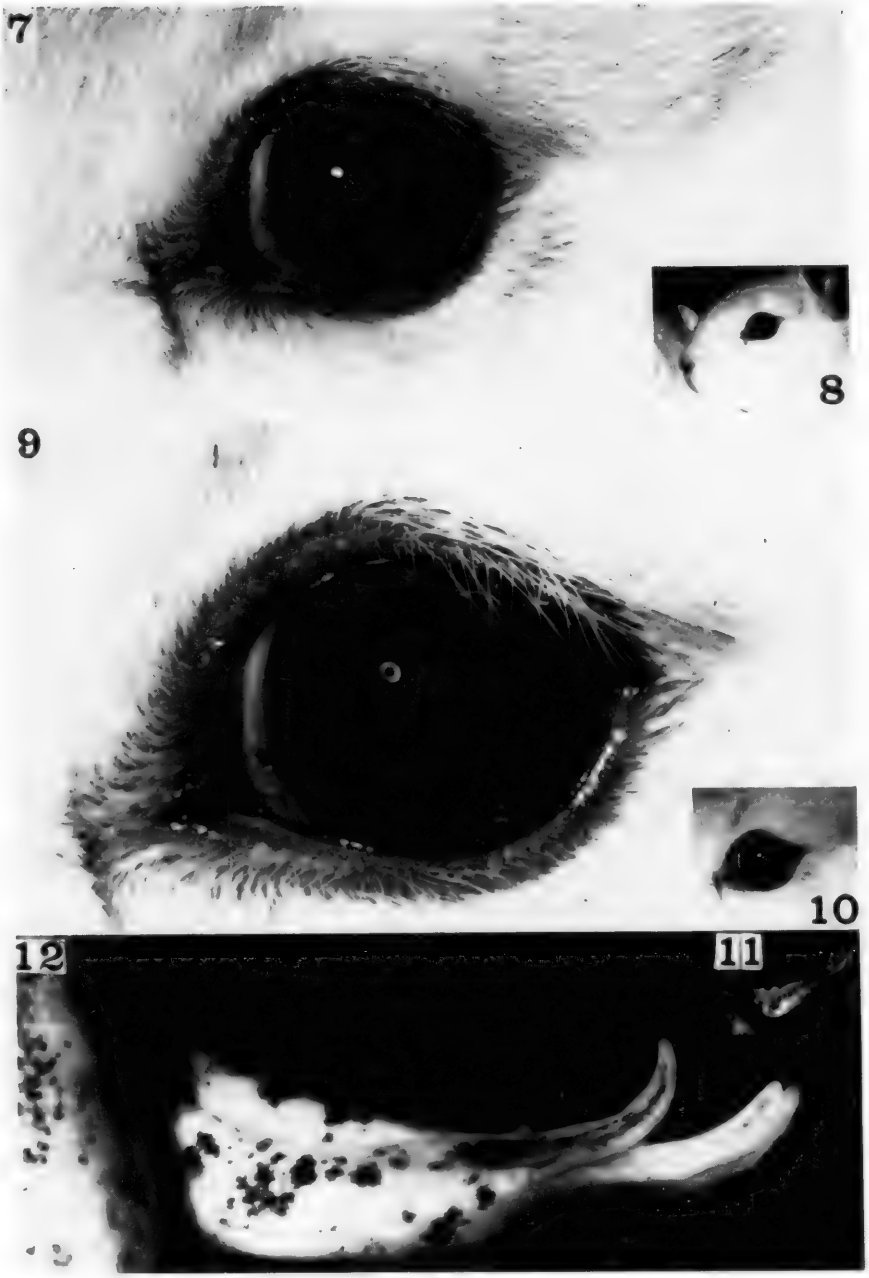
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by unsatisfactory focusing before exposure, as shown by the photographs of a rabbit eye (Figs. 7-10). These prints were made from two negatives. Figures 7 and 8 were made from a negative taken at a greater distance, and hence the image of the eye is less than half as large as that in the second negative (Figs. 9, 10). In spite of this, the first negative is slightly better, and the best enlargement is shown in Fig. 7. This is evident on comparison of the deepest portion of the eye, the left corner. The tiny blood vessels in the sclera are a little clearer in Fig. 7 than Fig. 9, because of slightly incorrect focusing of the second negative. This very slight difference in focusing is difficult to discover in contact prints. The photographs of the rabbit eye show clearly that in 35 mm contact prints (Figs. 8, 20) details are difficult to distinguish, but they are seen clearly upon enlargements (Figs. 7 and 9; compare also Figs. 11 and 12). With a really good negative, enlargement possibilities are enhanced.

One of the important factors in obtaining a good negative is correct focusing. Focusing is easy when the animal is anesthetized or held in position. It is much more difficult when the animal is not anesthetized and moves relatively quickly. The photographer must wait until the moment when the animal is in a good position, focus quickly but carefully, adjust the lens diaphragm and then make the exposure. If this is not possible, the photographer may focus on a substitute subject (using a piece of wood or other material), adjust the lens diaphragm, remove the substitute subject, wait until the animal is in the desired position, and simply make the exposure. An identification label and a scale (preferably calibrated in millimeters and centimeters), may be photographed along with the animal.[1]

An important feature of 35 mm cameras is that film is relatively inexpensive, and changing the film after many exposures is accomplished quickly and easily. Therefore, several exposures of the same animal are possible, permitting selection of the best picture. More important, pictures of all animals in an experiment can be made economically at definite time intervals. Such photographs constitute the best record of the effect of some types of treatment on experimental animals. The processing of many negatives on 35 mm roll film is simple and is usually accomplished much more rapidly than that of an equal number of individual large negatives.

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Figure 7. Photograph of rabbit eye. Electronic flash, f/16, Panatomic-X film, enlargement.

Figure 8. Contact print made from figure 7 negative.

Figure 9. Photograph of rabbit eye. Electronic flash, f/16, Panatomic-X film, enlargement.

Figure 10. Contact print made from figure 9 negative.

Figure 11. Close-up photograph of the limb of adult white axolotl. Electronic flash, f/16, Panatomic-X film, contact print.

Figure 12. Enlargement made from figure 11 negative.

Photographing Small Mammals

Most of the experimental animals were photographed without anesthesia in our work, since even the best anesthetics are hazardous to some degree for animals, especially animals that are affected by the experimental treatment and must be repeatedly photographed. Photographs may be taken from a relatively long distance (Fig. 3), but even then the animals must be in a definite position. When pictures are taken from a shorter distance to obtain greater clarity of detail, as in most of our work (Figs. 5, 6, 12), the position of the animal is even more important.

Unanesthetized small animals, such as mice or hamsters, must have their field of motion restricted when they are photographed. I have used a large inverted glass beaker for this purpose. A piece of gray cardboard (about 3″ x 4″) is attached to the top of this beaker with adhesive tape, and a larger piece of cardboard serves as background (Figs. 13, 15). The camera with attachments is supported rigidly on a heavy tripod. Figures 13 and 15 are contact prints, and Figures 14 and 16 are enlargements. Enlargement alone reveals sufficient detail. A photograph of a portion of the head of the hamster was taken without anesthetic, but the animal had to be wrapped in gauze and held by an assistant. Comparison of the contact print (Fig. 17) with the enlargement (Fig. 18) again shows that all details are much clearer in the enlargement.

To photograph from above, the vertical wall support, already described, can be used. Photographing anesthetized animals is so simple that further comment is unnecessary.

Photographing Aquatic Animals

Aquatic animals are much more difficult to photograph than are mammals, because of the problems of reflection and refraction created by the water in which the animals are immersed. We use a crystallizing dish, 9¾ inches in diameter and 3 inches deep. Seven blocks of polished glass (made by special order) limit the animal's field of movement in the dish. The blocks are all 1″ high but vary in other dimensions: two are one inch wide and 8 inches long, three are ½ inch or ¾ inch wide and 5 inches long; the two smallest are ¾ inches wide and 2 inches long. Utilizing different combinations of these blocks the animal can be kept within a definite area of the dish. This dish is supported by four diagonal wooden beams with end laps about ¼ inch long (Fig. 1, I and II; SS), thus leaving the central area of the

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Figure 13. Photograph of mouse. Electronic flash, f/16, Panatomic-X film, contact print.

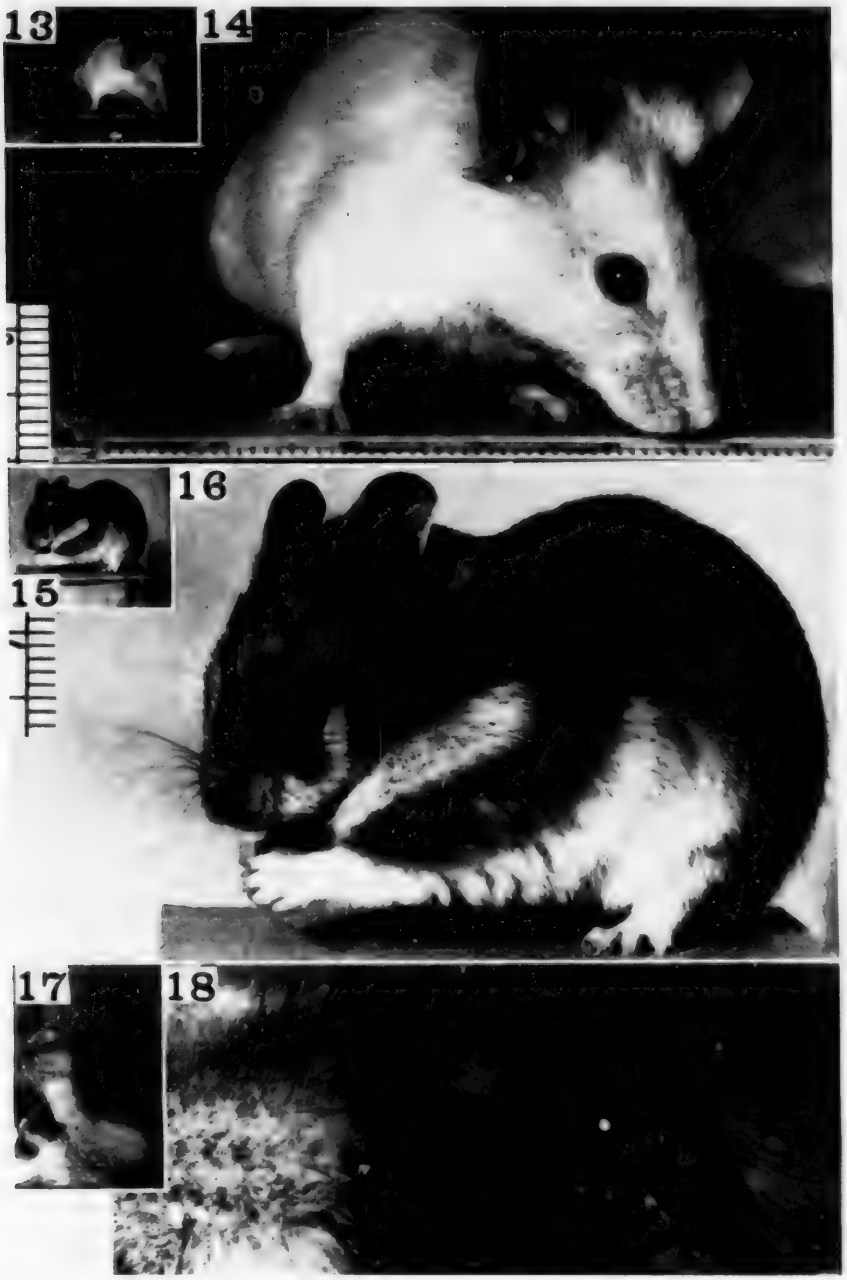
Figure 14. Enlargement of figure 13 negative.

Figure 15. Photograph of hamster. Electronic flash, f/16, Panatomic-X film, contact print.

Figure 16. Enlargement from figure 15 negative.

Figure 17. Close-up photograph of portion of the head of a hamster. Electronic flash, f/16, Panatomic-X film, contact print.

Figure 18. Enlargement from figure 17 negative.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dish unobstructed. Moveable wooden strips (Fig. 1, A and B) can be adjusted to define the photographic field. All portions of the support exposed to moisture are painted with enamel. A scale is placed in the bottom of the container, and kept in place by glass blocks at its ends; an identification label is attached to the outside on the bottom of the dish.

The water in which small aquatic animals (such as the axolotl, Figs. 3, 4) must be absolutely clean and should be changed often, i.e., after photographing 2 or 3 animals (depending on their size). Since frequent water changing is impractical, we prefer to have running water in the photographic container (Fig. 1). The inlet is a glass tube connected with the faucet of the main water line. The temperature is regulated by adding hot water. A self-starting neoprene siphon with a hand pump (Mountain Industries, Box #92, Summit, N. Y.) removes water from the container satisfactorily. The siphon is connected with a plastic-covered metal pipe adjusted to the container.

We use one 500-watt photoflood lamp, attached to the wooden support (Figs. 1, 2), as a light source during focusing. A black or dark gray background is used when photographing white animals. With dark animals an illuminated white background positioned obliquely toward one 500-watt photoflood lamp attached to a lower portion of the container support is used.

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The Role of Photography In Pediatrics

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KNOWLEDGE may be transmitted from one person to another by means of speech or by visual displays and ordinarily both measures are employed. However, the ability of the individual to acquire and to retain such information varies, as some learn more readily by sight than by hearing. The validity of this statement was well demonstrated during World War II when rapid instruction of thousands of men became necessary. Audio-visual education was employed and it soon became apparent that of the two measures, visual education was the more practical and rapid means. As it was my duty to teach both staff and line personnel of the U.S. Navy the medical aspects of chemical warfare prior to the invasion of Normandy, I was able to confirm this viewpoint from personal experience. The same situation exists in the teaching of medical personnel, whether they are medical students, nurses, interns or post-graduate students. The statement, "seeing is believing," still holds true.

Today the well-equipped teaching center has its own department of photography for the preparation of photographs, lantern slides and moving pictures to be employed for demonstration purposes. The following figures from the Photography Department at the Children's Medical Center, Boston, indicate how extensively this service is used. During the year 1949, 7,732 photographs of 2,906 patients were made and incorporated into the patient's record, 1800 lantern slides prepared for teaching purposes, 9,567 negatives processed and 12,122 photographs made for scientific and other publications, apart from the field of moving pictures. The preparation of this material is only a part of this department's function, as it advises concerning methods of presentation of teaching material, prepares demonstrations and displays for medical conferences and conventions, maintains a catalogued lantern slide library and has available for immediate use all photographic equipment required for the presentation of visual aids. It is thus apparent that a department of photography is now an integral and essential part of a teaching institution.

Photography is particularly important in the study of pediatrics, because in no other field of medicine does the patient change so rapidly. The growth and development of the normal child, apart from the temporary aspect of what ails him, presents such a constantly changing picture that only with the aid of photography are we able to fix an accurate description of the patient at any one time of his life. A pictorial chronological history is thus established.

An equally important role of photography in pediatrics lies in the field of surgery, and particularly in plastic surgery, as this enables the surgeon to study the end result of the operation compared with an accurate and detailed picture of the patient made before the

operation. The maximum cosmetic effect is thus achieved in the case of infants and children with cleft palate or hare lip, unsightly and deforming hemangiomas, as well as in the orthopedic correction of deformities following such a disease as poliomyelitis. In surgical research photography also plays an essential part, as here again it presents to the surgeon an accurate record of the various procedures employed and allows him an opportunity to study and develop new and improved techniques.

Medical education does not end with the acquisition of an M.D., but must be maintained throughout the entire period of active practice if the physician is to give his patients the best of modern medical care. Frequently, however, the busy pediatrician or general practitioner (who cares for 76 percent of the children in the United States) cannot find the time to avail himself of the various post-graduate studies or refresher courses offered at the principal teaching centers. The excellent medical journals received in his mail do not entirely replace the give and take of the medical forum. How then can his needs be met? Once again photography fills the gap with displays, lantern slides and moving pictures for presentation at the local hospital or district medical society. These, coupled with the recent advances in television, and microfilm summaries of current pediatric topics, are invaluable aids to the rural practitioner in keeping him abreast of the newest developments at the centers of research.

There is another state of affairs created by the very excellence of our modern public health methods. It sometimes happens that even our best-educated trainees from the largest medical centers may go out to practice without ever having seen some of the diseases common only a generation ago. Widespread introduction of immunization procedures and the use of chemotherapy and antibiotics have made a comparative rarity of such disease processes as diphtheria, tetanus, smallpox, erysipelas, scarlet fever with its mastoiditis, and septicemia with accompanying purpura. The historical recording of photography of these disease manifestations among infants and children enables the young practitioner to identify the odd cases which may present themselves, even though he may never have encountered them in clinical form before. It is even possible by this means for him to make a differential diagnosis from the confusing symptoms presented by the tonsillar exudate of infectious mononucleosis, acute tonsillitis and diphtheria; or from the old-fashioned "bull-neck" of malignant diphtheria with peritonsillar abscess or retro-pharyngeal abscess. And photography is often his only contact with the diseases of other regions, such as leprosy, gout, filariasis etc., which he must always be ready to suspect, however rarely they may intrude themselves into his territory. Recognition of these exotics becomes all the more important as the age of air transport decreases the size of the globe and widens the frontiers of disease.

We cannot therefore overemphasize the important position which photography and the allied arts have established for themselves in any hospital, medical school or teaching institution. Memory is transient and fallible but photography makes a permanent record of the changing facies of health and disease in the growing child. Its possibilities are still limitless and if television continues to progress at its present alarming rate, who knows, the photographer may yet displace the professor.

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Photography of Agar-Gel Diffusion Microslides

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Introduction

A PHOTOGRAPHIC method was devised to record the zones of precipitation (reaction of antigen with antibody) in the microslides used in the agar-gel diffusion method described by Grasset.[1] The photographs are used to interpret the slides as well as to prepare a permanent record.

The problem of photographing agar-gel microslides is one of resolving dense light scattering lines (zones of precipitation) against a background of the somewhat less dense light scattering agar-gel. The method we use consists of photographing, on 35 mm film, the zones around each group of wells on the agar-gel microslides, using oblique transmitted light. The illumination is critical, and must be flat and even in the plane of the microslide. Photographic enlargements, 4″ x 5″, are made of each negative.

The advantages of the method are: (1) ease of reading enlarged photographs of the zones as compared with viewing the zones with a magnifying glass, (2) elimination of errors of visual perception in drawing zones, (3) elimination of the tedious process of drawing the zones manually, (4) convenience of comparing zones in several microslides, (5) increase of resolution of faint zones and complex multiple zones of different intensities, (6) establishment of a permanent record of the zones at various time intervals without stopping the reactions, (7) elimination of staining of the zones for conventional photography.

The disadvantages of the method are (1) cost of the optical equipment (approximately $550.00, including the camera), (2) the time of taking and processing the photographs (although we have photographed 50 microslides in 20 minutes and made 4″ x 5″ enlargements in 3 hours), (3) the cost of processing the film and photographs (we have found that the cost of materials for processing 1,000 pictures is approximately $50.00).

Description of Apparatus

The component parts arrangement of the photographic assembly can be seen in Figure 1. Note the light path.

1. A 35 mm single lens reflex camera is set up on an enlarger stand and arranged for photographing small objects, using transmitted light. The focusing arrangement of the camera must be of sufficiently high quality to see the fine lines well enough for focusing.

2. A 50 mm focal length lens is used together with extension bellows. The

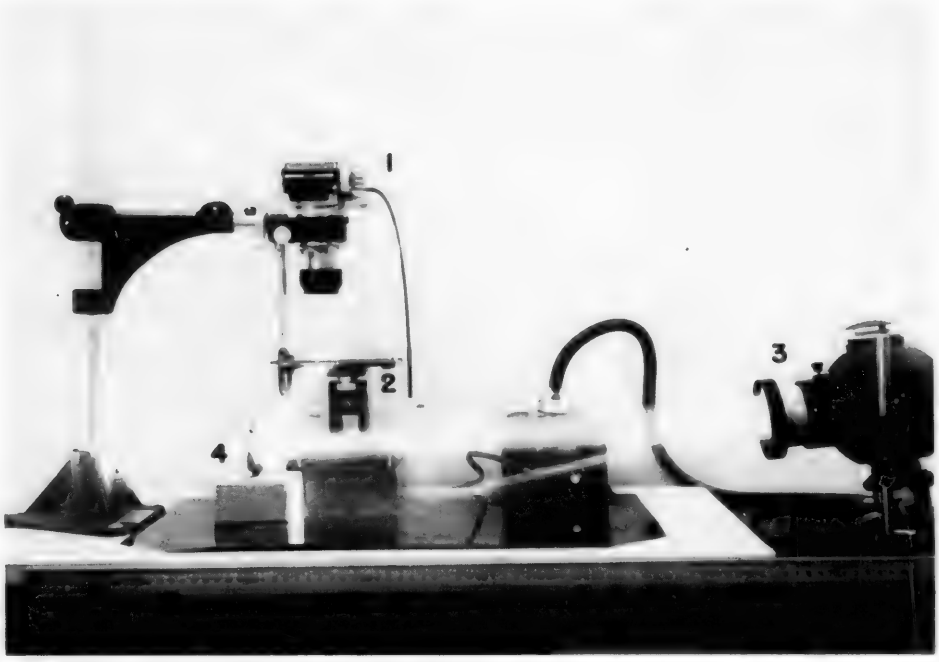

Figure 1. Equipment for photographing agar-gel diffusion microslides. Note path of light.

1. Camera, extension bellows, lens.
2. Stage with microslide.
3. Ribbon filament lamp with aspheric condenser.
4. Mirror.

lens must be of high quality. We use an f 3.5, 50 mm, Elmar (Leitz).

3. A rack and pinion (not shown in photograph) are mounted between the camera and stand for focusing.

4. A ribbon filament microscope lamp is used for illumination.* The lamp is a horizontal ribbon filament lamp, GE 18A/T10/2P-6V. The base should be ceramic. A 6V transformer capable of handling 18 amps is necessary. An aspheric condenser (Bausch and Lomb) is used for the lamp condenser. The lamp housing should have a chimney for dissipation of heat.

5. A microscope substage mirror is used to reflect the enlarged image of the filament onto the microslide at an angle of 45°.

6. A stage with a transparent top is used to mount the microslide for photography.

A ribbon filament lamp with an aspheric condenser is preferable to a coil filament lamp or lighting methods using a diffusing screen (ground glass) and

*The lamp assembly and complete equipment is available at Technical Instruments Company, 98 Golden Gate Avenue, San Francisco, California.

biconcave condensers, because a fairly large area must be illuminated evenly, with no image of a coil filament or diffusion screen in the plane of the microslide.

Arrangement of the Equipment and Description of the Method

The back of the camera is set approximately 130 mm above the microslide (standard glass 1″ x 3″ microscope slide) to be photographed. The center of the mirror is 7½ cm from the base. The transparent stage is 16 cm high. In order to provide oblique illumination, the angle of the mirror is adjusted to approximately 45° to the microslide. The camera back and transparent stage should be parallel and level. A machinist's bench level is useful for leveling the camera back and stage.

The extension bellows is used to obtain an image in the camera view-finder of approximately the same size as the group of wells on the microslide to be photographed. The extension bellows is not used for focusing.

The image of the group of wells is brought into focus by moving the camera up and down on the stand, but a small rack and pinion gear mounted between the camera and stand is more convenient for this purpose. The camera is fixed in position of sharpest focus of the image.

An enlarged image of the ribbon filament is focused on the mirror, filling the mirror with light. The light is reflected at an angle of 45° through the microslide. The lamp is used at full intensity.

The camera lens is stopped down to f 11 or at a stop that will produce a good negative, using an exposure time of 1 or 2 seconds.

Photographic Technique

Any technique that will give high resolution with high contrast will suffice. We use Panatomic X (Eastman) film, and develop it in D 76 (Eastman) for 10 minutes. A high contrast enlarging paper is recommended. We use Kodabromide (Eastman) No. 4 contrast and develop in Dektol (Eastman). Occasionally No. 3 or No. 2 contrast paper is used.

Results

Figure 2 is an example of a photograph of zones of precipitation in a microslide. The center well contains anti-human placental gamma globulin rabbit serum. The upper left well contains 4.0 mgs. of Cutter placental gamma globulin protein (pggp). The upper right well contains 2.0 mgs. pggp. The lower right well contains 0.20 mg. pggp. The lower left well contains 0.02 mg. pggp.

Figure 2. Photograph of agar-gel diffusion microslide. Anti-human placental gamma globulin rabbit serum is in the center well. Various concentrations of Cutter placental gamma globulin protein are in the outer wells.

Summary

1. The equipment and method for photographing zones of precipitation in agar-gel diffusion microslides has been described.

2. An example of a photograph of the zones of precipitation of an antigen-antibody reaction in an agar-gel microslide has been presented.

I should like to thank Mr. Rondal Partridge for his services as a photographic consultant in working out some of the problems of this photographic technique.

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Tenth Anniversary Exhibit Photography at Mid-Century Scheduled to Travel to Leading Museums and Art Galleries Through 1961

A traveling version of PHOTOGRAPHY AT MID-CENTURY, the Tenth Anniversary Exhibition of the George Eastman House, will leave Rochester in early June to circulate within the United States through 1961.

PHOTOGRAPHY AT MID-CENTURY opened on the museum's anniversary date of November 9, 1959. It included the work of 264 contemporary photographers, as a survey of significant work done during the past ten years, as selected by the photographers themselves. The traveling version contains 257 photographs from the work of 158 of the photographers in the original exhibition.

Exhibition Schedule

1960	
June 5 - July 3	Walker Art Gallery—Minneapolis, Minnesota
July 15 - Aug. 15	DeYoung Memorial Museum—San Francisco, California
Sept. 8 - Oct. 16	Wadsworth Atheneum—Hartford, Connecticut
Nov. 4 - 27	Addison Gallery of American Art—Andover, Massachusetts
1961	
April	The Museum of Fine Arts—Boston, Massachusetts

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The Use of Ansco Color Duplicating Film Type 538 for Photomicrography

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THE results obtainable in 35mm color photomicrographs are directly related to the type of film used. One must make an initial decision as to whether having photographs immediately, or fineness of grain and resolving power are the primary objects. With Ansco Color Duplicating film it appears that both qualifications may be satisfied with results equal to those obtainable with other color reversal films for 35mm.

There are several advantages in the use of Ansco Color Duplicating film type 538 for photomicrography. One of the most obvious is the time elapsing between taking the pictures and viewing them. Color photomicrographs can be ready for projection in approximately two hours after the last exposure is made. This incidentally is also true of Ektachrome and Anscochrome, however the difference in grain and resolving power is quite marked.

A second advantage is the complete elimination of all color correcting filters in the system. Using a Bausch & Lomb ribbon filament illuminator the input voltage to the lamp is regulated at 90 volts, and the lamp switch set on high. The voltage at the lamp socket is then approximately 4.5 Volts. Using this procedure, the color rendition will be excellent. If no variable transformer is available to control the input voltage, approximately the same results can be obtained with a line voltage of 115 if the lamp switch is set on low. The final color temperature of the lamp in this case is only slightly above that of the lamp in the previous method, and within the tolerance limits of the film. It is recommended that each setup be calibrated since bulbs will vary with age, line voltages will vary from area to area, and the lens systems involved may cause slight changes in color rendition. However, if a variable transformer is used on the input the above variables can be compensated for by varying the input voltage up or down depending on the direction of color distortion.

The processing of the film is done using standard Anscochrome color developing chemicals with the exception of the color developer. The recommended color developer is Ansco Duplicating Film color developer. This is available in 3½ and 10 gallon units. The recommended times for development are as follows:

first developer	8 min
shortstop	1 min
hardener	4 min
wash	3 min
re-exposure	3 min
duplicating film color dev.	7 min

shortstop	1 min
hardener	4 min
wash	2 min
bleach	5 min
wash	3 min
fix	4 min
wash	10 min

These times are the same as for Anscochrome film with the exception of the first developer and the color developer. According to Ansco, Anscochrome color developer may be used but top quality cannot be expected with the Anscochrome color developer. If Anscochrome color developer is to be used, Ansco suggests the following times be tried. First developer time of 8 minutes, and color developer time of 6 min. One of the disadvantages of using Anscochrome color developer is reported to be an increase in contrast, so for some instances it may be desirable to use the developer to achieve this increase in contrast. With the material developed with either of the methods given above, one precaution is very necessary. Re-exposure is much more critical than with Anscochrome film. The best results were obtained by unspooling the film from the developing reel, placing it in a white photographic tray filled with water, and the exposure made while the film was immersed and unreeled.

Many laboratories may already have Ansco type 538 film and processing chemicals on hand for making duplicates and therefore no additional supplies will be needed. If Anscochrome is used in the laboratory the only additional supplies required will be the type 538 duplicating film and the Color Duplicating film color developer. Since the quantity of developer in a 3½ gallon size is sufficient to develop approximately 112 36 exposure rolls of film, it is evident that the developer will spoil before it will all be used up. This has been prevented in our laboratory by dividing the developer into quart sized plastic bottles and freezing them until they are ready for use. The exact length of time that the developer can be kept under these conditions is not yet known, but the storage time is greatly extended. Also, the cost of the 3½ gallon size of duplicating film color developer is little enough so that some may be discarded and the cost of making the transparencies is still far below that of using regular color film.

The film has a very low sensitivity, and requires long exposure. Ansco lists the sensitivity as being twice that of Ansco Printon. We have found no difficulty in using a Photovolt exposure meter model 200-M to measure the light. The light was read from the side tube of the Leitz Micro-Ibso device, and a typical exposure for an oil immersion objective with a light stained slide is about 10 seconds. This is given as a guide for calibration with the equipment available. The film has a rather wide latitude and this makes the use of it less susceptible to slight errors in exposure.

Summary

The use of Ansco Color Duplicating film type 538 for 35mm color photomicrography has the advantages of obtaining top quality results in a short time at low initial cost, and eliminates the need for expensive color correction filters. The cost of the film in 100 foot rolls is approximately one-fourth that of other reversal color films in similar quantities.

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Radiographic Reproduction

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THE problem of making good reproductions of radiographs centers around the different tone scales inherent in various photographic materials and viewing media. Radiographic material has a tone scale as high as 1:1000, or far beyond any ordinary photographic film. There is also a tone scale difference between negative materials, lantern slides and printing papers. The tone scale registered by the average film is of the order of 1:150; for the average paper it is about 1:50. The scale registered by lantern slide plates lies somewhere between these figures. The above figures are not intended as scientific statement of fact, but as a guide to show what problem must be overcome. Another item which must always be considered, is the viewing medium. Radiographs are viewed by transmitted light and prints are viewed by reflected light. A much greater amount of detail can be seen by transmitted light, which may be a partial explanation of the reason why so many individuals are disappointed with radiographic prints.

The old method of reproducing radiographs was to make a print directly from the radiograph by contact printing. This is never satisfactory for several reasons, it causes the viewer to make a mental reversal of the radiograph in an effort to visualize it as the normal negative form in which it is usually viewed. Also, much of the detail is obliterated by this method. If positive prints *must* be made, they are usually printed by contact in a printing frame. It is *not* a recommended procedure. Modern photographic materials have allowed a reasonably presentable reproduction to be made, by the use of an intermediate film copy. In many instances it is not yet possible to make an exact reproduction, but it can be closely approximated.

The answer to the problem lies in the use of long scale negative material, and careful development, which will be discussed later. Great care is necessary when prints are made, to choose the correct contrast of paper, and to do any hand work necessary, such as shading or dodging thin negative areas. Even with expert printing ability, it is rare for a print to be an exact reproduction of the radiograph because of the different viewing medium. A lantern slide will most nearly duplicate the radiograph because it is viewed in the same medium. Even here the slide will have to be expertly made if the fine detail and gradations of the original radiograph are to be preserved, but again the tone scale of the slide does not equal the tone scale of the radiograph.

Frequently it is desirable to use only a portion of the radiograph in order to concentrate attention on the area under discussion. Care must be taken to include enough landmarks so that the area can be identified.

Some individuals make use of a direct copy paper to make negative prints from radiographs without having to make an intermediate film. Paper of this type is produced by several manufacturers. It requires a special developer and special

handling. Most direct copy paper has a short tone scale. This means that radiographs of chests which have a short tone scale will come out fairly well, but most other radiographs have too long a tone scale to reproduce well with this medium. This paper has too much contrast for the long scale radiograph. In order to cut down the size of the print, direct copy paper can be placed in a cut film holder. The image can be focused as usual and the exposure made on the direct copy paper through the camera. Otherwise large sheets of the paper are needed if contact printing is employed.

An important point is the illumination of the radiograph. The light must be spread evenly over the film to be copied, or an unbalanced intermediate film will result. What sort of apparatus should be employed for the task? There are many setups that will serve very well. If a small number of films are to be done occasionally, a very simple setup consists of a camera and an X-ray illuminator. The illuminator may be either of the cold-light type or tungsten. Some of the cold-lights do not have enough intensity to penetrate dense radiographs. There will be a difference in the contrast of copies made by both types of illumination. The copy on the cold-light illuminator will have less contrast than the one on the tungsten illuminator. The camera should have a means of direct focusing on ground glass in order to be certain of sharpness of focus and inclusion of all the film being copied. A view camera is excellent for this purpose. The camera and illuminator must be so placed that the front of the camera and the front of the illuminator are parallel; if this is not done there will be false converging lines in the finished product. Another form of apparatus is a vertical camera and an indirectly lighted view box. The camera rides a slotted vertical board and is centered over the light box. A tripod screw through the slot in the board locks the camera in position. The same apparatus can be used for other purposes in the laboratory. Both of the above pieces of apparatus have a common fault in that they have a closed light source. By this is meant that there is no way in which shading can be done between the light source and the radiograph. With equipment of this type shading can be accomplished by using a black card and cutting a rough mask of the area to receive less exposure. Hold the card about 2 in. in front of the illuminator, cover the area it is desired to shade and keep the card in motion slightly to prevent the sharp edge of the card from appearing on the intermediate film. The amount of additional exposure given in this way will vary with the density of the areas to be given additional exposure. Trial and error is the best way to obtain good results. The result is not altogether satisfactory when shading is accomplished in this manner, as small areas cannot be worked with certainty. Still another apparatus uses a lamp box containing thirty 50W lamps arranged in rows with an individual switch for each lamp. Shading is accomplished by turning off various lamps. Again it is difficult to shade small areas well.

An apparatus which the writer has used for many years eliminates most of these difficulties and allows accurate shading and local control. Intermediate films can also be produced rapidly with this apparatus. The apparatus consists of a skeleton stand 6 ft. long and 14 in. wide. Two sliding stands 14 in. square ride on the stand. On one of

the stands a square "U" shaped frame is fastened. The uprights have a ¼ in. groove cut in them. A piece of clear and a piece of flashed opal glass are hinged together at the top with adhesive tape. This glass "sandwich" carries the radiograph to be copied and is placed in the grooved uprights. A black paper mask is used for all films which do not fill the glass area. The mask and radiograph are placed between the two sheets of glass. No free light should pass the outside dimensions of the film, or fog may result on the intermediate film. The camera is placed on the other sliding stand. A tripod screw will hold it in the parallel position. If two exposures are to be made on one film, using a sliding cut-off board in the camera back, it will be necessary to have a somewhat wider board fastened to the sliding camera stand, so that the camera may be placed off center for each exposure. In this instance, no tripod screw is used but parallel lines are scribed on the baseboard and the camera base is aligned with them to preserve parallelism between camera and radiograph. The width of this board will be governed by the focal length of the lens used and the largest size radiograph to be copied. The camera *must* be kept parallel with the radiograph at all times. At the end of the stand containing the glass, a fixture containing a 500W lamp is placed. Over the lamp is placed a light cone to confine the light to the glass holding the radiograph. There must be no spread of light beyond the margins of the glass unless baffle shields are used. The light cone should be rectangular at the outer end and the size can be varied as long as it produces an even light and confines the light to the back glass. A cone length of about 17 in. is about right with the lamp at the rear of the cone. The outer edge of the cone should be 12 in. from the glass holding the radiograph. Shading is accomplished between the light cone and the back glass.

Some intense local light is frequently necessary to bring out very dense areas in the radiograph. This is accomplished by a 100W lamp set in a funnel shaped reflector. An iris diaphragm fastened to the open end will aid somewhat in controlling the size of the emitted beam of light. An optical system using a condenser in back of the iris and a projection lens in front of it would allow focusing and control of the diameter of the light beam. To use the local light, the primary exposure is made with the main light, then it is turned off and the local light is inserted between the glass and the cone. The local light is held very close to the back glass and carefully worked over the dense areas it is desired to lighten. Care must be taken not to encroach on the normal areas and to keep the local light in constant motion. A little practice will determine how much extra exposure is needed and vastly improved reproductions will result. A flashlight can be employed in place of the local light described, but has the disadvantage that the battery gradually w .ens which makes it difficult to deter now much added exposure is necessary. A small penlight with fresh batteries is useful to work very small areas.

An exposure meter is invaluable for computing exposure. Meters such as the Weston, GE, or Norwood (the latter used by substituting the Photo Grid for the cone) work very well. The writer's method is to place the top edge of the meter against the front glass over an area of average density, with the meter held at an angle of about 30 degrees

for ease in reading the dial. Several readings in areas of widely varying density may be made, and an average worked out for the whole film.

Some form of computing the effective aperture of the lens must be worked out, as most of this work is done at less than 8 times the focal length of the lens employed, which means that the actual and the effective f stops are not the same. The Kodak Effective Aperture Guide works well for this purpose. Some exposure meters can be used as a slide rule for this purpose.

The most important factor of all is the selection of the best film to use for copying radiographs. Remember that it must be a film which will register a long scale of tones. The writer's preference is a sheet film similar to Kodak Ortho-X. Some of the fast panchromatic sheet films have a long scale, but do not produce as long a tone scale from radiographs as will orthochromatic material. For users of roll film, film pack and 35mm. film the best results will be had by using a film similar to Kodak Plus-X panchromatic film. There is no good orthochromatic 35mm. film available at present. Care must be taken in the use of 35mm. material that no loss of resolution occurs in reducing large films to this size. For special purposes, such as increasing the contrast of very flat (lacking in tone scale) radiographs, a short scale film such as the ordinary commercial or even process film will add much to the radiographic copy. Sometimes, when only a little additional contrast is needed, a fast panchromatic film will produce results, but for the most part film of the Ortho-X type will produce the best work.

Proper development is of great importance in the recording of tone scale. For many radiographs, particularly those treated by local light, normal development in a developer similar to DK60A is desirable. When radiographs of great contrast are copied the best overall results will be gained by using a developer having the characteristics of D76. Much the same results can be obtained from radiographs of this kind by overexposure and underdevelopment in DK60A. This will reduce the tone scale to a point where better reproduction will result. Some experimenting in the amount of overexposure and underdevelopment is necessary before the best results can be obtained.

Motion pictures of radiographs can be made by substituting a more powerful light source (1000W) in the lamp house of the copying apparatus. Some radiographs are too dense to be well recorded by motion pictures. With films of this sort an 8 frames per second exposure instead of the usual 16 or 24 is recommended. The motion picture camera must be centered on the radiograph and be securely fastened so that vibration will not cause quivering on the projection screen. Either black or white or color film can be used successfully. In radiographs of great density it may become necessary to copy with the still camera, then make a print and mount it on black paper. Then a motion picture of the print can easily be made.

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Photography Hall of Fame Selections

THE international PHOTOGRAPHY HALL OF FAME, which is being developed by the American Museum of Photography in conjunction with its future plans to move to new headquarters in New York City, is rapidly taking shape. The first selections will be from the great inventors and scientists who have made major contributions to the development of the art-science of photography as a major part of present-day social, economic and technological life.

These first selections are being made by a large committee comprised of international authorities on photography and photographic history. Within the Committee there are five groups, or sub-committees, which are responsible for the nomination of names to be voted upon by the entire membership of the Committee of Selection. One of these groups, or sub-committees, will present the names of inventors and scientists from the United States and Canada, another will be responsible for nominations from the British Isles, a third will present those from France, a fourth will cover the great Germans, and the fifth will submit names from any country not included in the other four.

It is expected that each member will submit between twenty and twenty-five names of scientists or inventors from the area he represents, and that when submitted there will be between 150 and 200 names from all areas of the world. This total list will then be compiled and a copy thereof sent to each member of the entire Committee of Selection for a final comparative rating. From these ratings based on international, rather than purely national, opinions it is probable that the 100 receiving the highest ratings will form the group for the first selection to the PHOTOGRAPHY HALL OF FAME.

This basis of selection was conceived by Dr. Louis Walton Sipley, the Director of the American Museum of Photography and the General Chairman of the Committee of Selection. During his past twenty years of intensive study and research in the history of photography Dr. Sipley has noted a tendency on the part of photographic historians to overemphasize in their books that area most familiar to the individual author and to omit or casually mention achievements or individuals in other areas. This is not to imply that such variation in emphasis has been intentional but rather to the fact that this phase of the graphic arts is less than 150 years of age and a complete international record of its history and amazing growth has not been made. By inviting the experts from the leading photographic countries of the world to participate in this world tribute to those who have made, and today are making, photography into a giant of the graphic arts, the American Museum of Photography hopes to reduce to microscopic size any bias for, or against, anyone, no matter what his country.

The membership of the complete Committee of Selection has not been

entirely filled at this time, but many acceptances have already been received. Among these are: Prof. Lloyd E. Varden of Columbia University and world famous consultant to the photographic industry; Miss Josephine Cobb of the National Archives in Washington, D.C.; Dr. Alexander J. Wedderburn, former head of the Photographic Division of the Smithsonian Institution; Dr. R. S. Schultze, head of the Research Library and Curator of the Museum of Kodak Limited at Harrow, England and himself an outstanding authority in photomechanical reproduction; Miss Margaret Harker, president of the Royal Photographic Society in conjunction with the Historical Committee of the Society; Helmut and Alison Gernsheim of London, the internationally famous students and writers of photographic history; Maurice Daumas, Conservateur of the Conservatoir Nationale des Arts & Metiers in Paris, where are housed some of the most prized photographic incunabula in the world; Paul Montel, greatest of French publishers of photographic books and periodicals, and a member of the Syndicat General de la Photographie; Dr. R. Zahlbrecht, Director of the Graphische Lehrund Versuchsanstalt in Vienna, greatest library of graphic arts material in the world; Dr. Othmar Helwich, publisher and editor of "Photographische Korrespondenz", outstanding German scientific photographic periodical since 1864; and Dr. R. Stevens of Belgium, Director of Scientific Coordination of Gevaert Photo-Producten. The great American graphic arts historian, Joseph S. Mertle, whose death has just been announced, had agreed to participate and his nominations from United States and Canada are already on hand and will be included in the final compilation.

The American Museum of Photography has already received through the assistance of Monsieur A. Landucci, president of Kodak-Pathe', as a gift from the French photographic industry, busts of Niepce and Daguerre. Their inclusion in the Photography Hall of Fame cannot be doubted.

Later selections will be made from those who have made major contributions in developing the industry and from the great practitioners in different fields of photography. For these selections in order to cover modern practitioners as well as historic, specialists in the different fields will be invited to participate in the nominations and selections. This should make for excellence in the choices made.

BOOK REVIEWS

LABORATORY IDENTIFICATION OF PATHOGENIC FUNGI SIMPLIFIED *by Elizabeth L. Hazen and Frank Curtis Reed of the Division of Laboratories and Research of the New York State Department of Health (Charles C. Thomas, Springfield, Ill.)*

The second edition of this book incorporates a few changes in the text of the first edition and additions of a section on "Contaminants" with numerous photographs of the kind for which this book is noted, and of two pages covering species of Candida other than **C. albicans.**

This book, since its original publication in 1955, has filled a need in diagnostic laboratories for a ready, compact reference work to aid in the identification of pathogenic fungi. The changes in the new edition have improved an already valuable work. If further improvement may be suggested, it could, in this reviewer's opinion, be brought about by the addition of a few more pages covering (a) the formulae for stains, and (b) the technique of handling specimens and cultures to visualize the details brought out in the photographs. The key point in the study of the fungi is the making of preparations in which the characteristic structures can be seen. The trial and error procedure employed by most laboratory workers could be shortened by the ready availability of detailed printed instruction in techniques.

Lois Almon

TRAITE PRATIQUE DE PHOTOGRAPHIE ET DE CINEMATOGRAPHIE MEDICALES *(Treatise on Practical Medical Photography and Cinematography) by Y. Bruneau, J. M. Dubois de Montreynaud, J. Jomain, and 14 other authors. Published by Publications Photo-Cinema, Paul Montel, Paris, France. (April 1960) The text is in French. 332 pages, cloth bound; 283 illustrations, (34 in color). Page size is 6 x 8 inches (16 x 22cm). Price in France is 26 N.F. May be purchased in the United States from Joseph D. Brubaker, 949 Sherman Ave., Evanston, Illinois.*

This book is valuable for its excellent illustrations alone—of equipment and endoscopic views—even if you do not read French. Much of the numerical photographic and technical data is obvious without knowing French.

There are 110 pages devoted to Endoscopic Photography (Section 2)—edited by Dr. Dubois de Montreynaud, present Secretary-General of the: "Societe Medicale Internationale de Photo-Cinematographie et Television Endoscopiques et de Radiocinematographie". Endoscopic methods currently used in Europe and throughout the world are described, with emphasis on quartz rod illuminated endoscopic telescope type equipment. Projected proximal illumination (including open-tube endoscopes) is discussed. Of special interest are the relatively new methods of illumination used with endoscopic telescopes:—quartz rod illumination (with tungsten lamp or electronic flash) water-cooled lamp — 2-filament lamp — and electronic flash at the tip of the endoscopic telescope.

The various types of equipment are fully described and well illustrated, including all of the modern equipment manufactured by European manufacturers. Throughout the section on endoscopic photography, the photographic technical data for each method is given, such as: Type of Film, ASA Exposure Index, Exposure Time or Frames per Second, Image Diameter on Film, and Focal-Length of Camera Lens used to produce this image diameter.

The second half of the section describes the practical step-by-step procedures of photography in the nine specialties listed below from the surgeon's point of view. The equipment described, and procedural steps are well illustrated. The majority of endoscopic views shown, are for bronchoscopy, but all of medical specialties listed below are well represented by typical views.

Dr. Dubois de Montreynaud has been very liberal with photographs of the step-by-step procedures in the use of quartz rod type equipment developed in France by Fourestier,

Gladu, & Vulmiere, as used for bronchoscopy. This quartz rod system has been adapted to instruments used in several other specialties. The use of television cameras with endoscopic telescopes by several workers is described.

While the book may be chiefly of interest from the standpoint of new information on endoscopic still, motion picture & television work—there are many pages devoted to special types of work in scientific and medical photography, cinematography, and radiography. Here we can find considerable new information and our memory will be refreshed about some of the well established standard procedures.

This book represents the summation of a considerable and diligent effort over a long period of time on the part of individual researchers producing the equipment and developing suitable technics, and on the part of the authors—and they are to be congratulated, as well as their publisher, Paul Montel, on a fine contribution to the permanent literature on endoscopic photography and other specialized technics.

Joseph D. Brubaker

THE PHOTOGRAPHY OF PATIENTS, *H. Lou Gibson, Second Edition (completely rewritten), Charles C. Thomas, Publishers, Springfield, Ill., 1960, 184 pages, cloth bound.*

This is a new edition of a manual which, after its first publication in 1952, quickly found its way into the hands of a great many hospital photographers. Rewritten and brought up to date, *Photography of Patients* covers much of its previous ground in regard to principles and theory of photography, while including modern equipment and discussing today's available photographic materials.

Lou Gibson has long been an exponent of good photography, accomplished within practical means. An expert, who regularly runs away with top Salon Awards, he has one of the important qualities of a good teacher: he can communicate in simple terms—without seeming to talk down—to his audience, or, as here, to his readership. Thus, one of the prime features of this book is that it appeals to both neophyte and professional. Many sections are directed specifically at the doctor who wants to practice good patent photography for record purposes. Enough simplified physics is included at this level so that he will understand why certain principles must be followed.

Yet the more experienced photographer will find sufficient data on specialized techniques and theories of optics to hold his interest. A lengthy chapter on Infrared Photography is one of the more comprehensive discussions. An excellent bibliography on this subject is included, and one might wish that this plan had been followed in regard to the subject matter of other chapters.

Since this book is concerned with a visual medium, the many illustrations contrasting results of right and wrong methods are most welcome. Proper color photography is well represented in the numerous plates. However, the system of keying the illustrations by number to the respective chapters is occasionally confusing, and a more simple method of reference might be suggested.

Few clinical photographers have the opportunity or time to make each picture a prize-winner. But there is no reason why everyone engaged in this work cannot learn routines, simple at first, and more advanced as he becomes proficient, which result in good pictures, portraying clearly the important features of each case. In *Photography of Patients* Lou Gibson clearly shows how to do this.

W. S.

PHOTOGRAPHY IN MEDICINE, *Arthur Smialowski and Donald J. Currie, M.D., Charles C. Thomas, Publisher, Springfield, Ill., 1960, 330 pages, $14.50, cloth bound.*

Today, standards of photographic acceptance have risen to the point where there is a long road ahead for the man who wishes to become a skilled clinical photographer, a proficient motion picture cameraman, and a top-notch photomicrographer. Yet, in smaller hospitals and medical units, one person is expected to combine all these techniques and to produce work in every field which stands up with the best—also to run an efficient department.

Photography In Medicine is designed for this man, and not for the specialist but, like the TV "Omnibus" series, there is here "something for everyone". A beginner would do well to skim quickly through the pages and then return to those chapters which ap-

ply particularly to his own position and work —such as the basic instructions on cameras and lighting.

For someone about to establish a photographic department in a hospital, there are details about layout, organization, equipment and filing. The man who has spent years photographing a special area, such as the eye or the ear, can learn fundamentals of general clinical photography or methods of working in the operating room, so that he can prepare himself for a position in a large hospital. There are individual chapters on photography of various body areas (eye, mouth, breast, etc.) and in the common specialties (orthopedics, dermatology, obstetrics, etc.). Copying, photomicrography and gross specimen photography are discussed in individual sections. The diagrams showing suggested lighting arrangements and darkroom plans are excellent, and it is commendable that more recent techniques, such as "Photography by Invisible Radiation" have been included.

Photography In Medicine is replete with pictorial examples, including many color plates. One should not carp on the fact, perhaps, that the black-and-white pictures are of an uneven quality. Because of trying to compress an immense amount of knowledge into one volume, each BPA member will doubtlessly notice the omission of certain ideas and procedures which he himself holds dear. For example, in the chapter on photomicrography, phase microscopy is not even mentioned: under "Motion Pictures", it is tacitly assumed that the original film will be projected after processing, a practice to be condemned insofar as possible. And one wishes that a little more emphasis (with visual examples) had been given to the question of not overloading slides with lengthy printed material or complicated graphs, a matter disposed of briefly near the end of its chapter.

In a text of this scope, it is inevitable that some important points will be neglected and differences of opinion will be elicited. Perhaps the authors will seek pertinent comments from specialists in each subject, and amplify or delete material, as the case may be, in future editions. As it stands, however, this book is certainly a noteworthy effort, and the authors are to be congratulated.

W. S.

The Second Midwestern Sectional Meeting
Milwaukee, Wisconsin

The Second Midwestern Sectional Meeting was held at St. Francis Hospital in Milwaukee, Wisconsin, April 1st to 3rd, 1960.

Highlight of the meeting was the presentation of five honor awards for excellence in biological photography selected from the Scientific Print Salon.

Recipients of these awards were Charles Harris, Medical School and Ellen Ryge, Dental School, of Marquette University: Stanley J. McComb of the Mayo Clinic Section of Photography: Robert P. Barber of the Department of Medical Photography, Macon County Hospital and E. Lynn Baldwin of Des Moines, Iowa.

The award for the best oral paper was presented to Stanley J. McComb for his paper on "The Problem of Depth of Field in Photomicrography".

"Dynamics of the Chick Otocyst", a time lapse research film by John Reineke was awarded a Certificate of Merit.

The third Midwestern Sectional Meeting will be held in Des Moines, Iowa in 1962. E. Lynn Baldwin was selected Chairman for this meeting.

Dorothy Pinkham

Annual Biomedical Electronic Program Scope Expanded

THE 13th ANNUAL CONFERENCE on Electrical Techniques in Medicine and Biology, scheduled for the Sheraton-Park Hotel, Washington, D.C., October 31, November 1-2, 1960, will feature a diversified program on biomedical electronics, with emphasis on analytical techniques.

Among the subjects to be covered are:

1. General: Flowmetering, Ultrasonic Mapping, Densitometry, Electrophoresis, Mass Spectroscopy, Microwave Spectroscopy, etc.
2. Electroanalytical Techniques: Polarography, Specific Electrodes, Coulometry, Titrant Generators, etc.
3. Waveform Interpretation: Heart Sounds, Nerve and Muscle Potentials, Cardiovascular Pressure, etc.
4. Cell and Particle Counting and Sorting.
5. Analogs.
6. Automated Analytical Methods.
7. Physiological Monitoring: Patients, Astronauts, etc.

As in the past, this meeting will be sponsored by the Joint Executive Committee in Medicine and Biology representing the Institute of Radio Engineers, American Institute of Electrical Engineers and the Instrument Society of America.

The conference will publish — immediately prior to the meeting — a 100-page printed report with 600-1000 word digests for every paper, and supporting drawings and photographs, for distribution to all registrants. The book will also include illustrated profiles of every speaker. Post-conference cost of this record will be $5.00.

Another highlight of this meeting will be an exhibit of commercial, institutional and scientific developments in the biomedical-electronic field.

R. L. Bowman, National Institutes of Health, Bethesda, Maryland, has been named chairman of this year's conference. Others on the committee include: A. L. Henley, National Instrument Laboratories, secretary: A. Shapero, Litton Industries, treasurer: G. N. Webb, Johns Hopkins Hospital, technical program and W. A. Wildhack, National Bureau of Standards, local arrangements. Five have been named to a special editorial committee: L. E. Flory, RCA Labs; A. L. Henley, National Instrument Labs; G. C. Riggle, National Institutes of Health; J. C. Jacobs, General Electric Research Lab. and P. Frommer, National Institute of Health. Lewis Winner, technical relations consultant, will handle public relations and exhibits.

New Products

ANNOUNCING THE NEW BEAU ROCCA "PRONTORMAT" ELECTRIC EYE CAMERA WITH COUPLED RANGEFINDER

Beau Camera Company, Division of Camera Specialty Company, Inc. is now introducing a new and completely automatic Electric-Eye Coupled Rangefinder 35mm camera. Called the Beau Rocca "Prontormat", the camera is quite unique. By moving the needle, the shutter speed and diaphragm are automatically set for picture-taking. The Electric Eye measures all the light, both shadow and sunlit scenes, then the "Prontormat" instantly sets shutter speed and lens stop with positive ac-

curacy — giving perfectly exposed pictures everytime! There are no dials to set, no shutter speed to set, no meter to set, no diaphragm to select. Result—no wasted shots, every picture perfect! The "Prontormat" Coupled Rangefinder focuses the picture perfectly, and you can shoot as fast as you push the film advance lever. Composition is precisely framed in the bright-line luminous viewfinder.

The Beau Rocca "Prontormat" F2.8, 45mm coated anastigmat lens assures superb picture quality with both color and black and white film. There are many more antomatic features which make the Beau Rocca "Prontormat" one of the most outstanding Electric Eye Coupled Rangefinder 35mm cameras. Price only $79.95 list. For more information, write to Beau Camera Company, 705 Bronx River Road, Bronxville, N.Y.

HERSHEY ANNOUNCES NEW "SUN-LITE SUNRING" ELECTRONIC FLASH

Doctors and dentists in particular will welcome the announcement of a new electronic flash unit developed by Hershey Manufacturing Co., Chicago. The miniaturized unit is called the "Sun-Lite Sunring," a ring type light designed for use in detailed close-up photography on an around-the-lens installation.

The new "Sun-Lite Sunring," according to E. J. Howard, Hershey sales manager, will aid professional men and others in obtaining shadowless close-up shots in both black-and-

white and color. The unit weighs only 1¼ lbs. and measures 5"x4½"x2¾". It operates economically from any 110 volt, 60 cycle AC outlet (single phase), and has a detachable 6 ft. line cord.

Versatile mounting of the "Sunring" permits its use with shoulder strap or on a surface (with rubber feet). Synchronization is "X" or "O" delay only, with 1/1300th second flash duration and five second recycling. Power rating is 50 watt-seconds, with 6500° Kelvin color temperature.

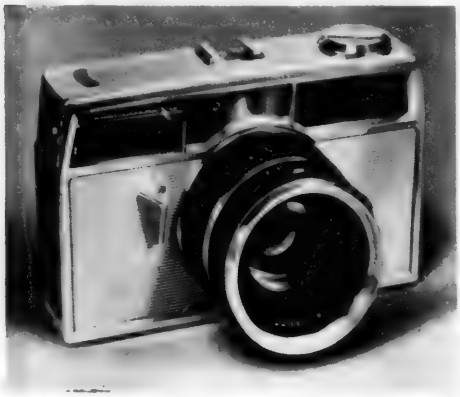
The "Sunring's" ring light fits both Series VI and VII lens mounts, the latter with an adapter ring. A bright neon ready light is built on the ring.

The "Sun-Lite Sunring" unit, complete, lists at $77.50 (a power-pack is available at $34.95). For further information, contact Hershey Manufacturing Co., 4309 West Lake Street, Chicago 24, Illinois (telephone MAnsfield 6-2612).

ANSCOMARK M ADDED TO ANSCO PRECISION CAMERA LINE

Ansco, Binghamton, New York, has announced the Anscomark M, a 35mm precision camera designed for the quality-conscious camera user who wants the finest in an interchangeable lens camera with coupled exposure meter control.

The Anscomark M viewfinder permits simultaneous viewing and focusing with all lenses. It features parallex corrected bright color-



coded frame outlines for use with each of the interchangeable lenses including normal, wide angle, and telephoto. The parallex correcting finder functions accurately at all distances from 3 feet to infinity.

The Anscomark M "match needle" meter controls permit the user to pre-select either shutter speed or lens opening on separate control rings and adjust the exposure accordingly by aligning the meter indicators.

The shutter and aperture controls may be operated independently or jointly without disturbing the basic correct exposure. The meter covers a wide range of lighting conditions and a full range of film speeds. A metal protective shield acts as a shade to prevent erroneous sky readings.

The Anscomark M shutter and lens mount is designed to support the lens directly to the camera body—the shutter mount is thus safely enclosed . . . away from accidental damage. The interchangeable lenses are safely locked in the mount, yet easily changed. The shutter is designed so the user can safely change to any speed, including 1/500th sec. whether or not the shutter is cocked.

Synchronization is full M-X type with self-timer. A unique "lock" prevents accidentally changing the synchro-settings.

The Anscomark M comes equipped with an f/1.9 Xyton or f/2.8 Xytar—50mm lens. An f/3.5 Xyton—35mm wide angle and an f/4 Xyton—100mm telephoto lens are available.

List Prices:

Anscomark M with 50mm f/2.8 lens	*$134.50*
Anscomark M with 50mm f/1.9 lens	*159.50*
Case	*12.50*
35mm f/3.5 wide angle lens and case	*59.50*
100mm f/4 telephoto lens and case	*79.50*

GRAFLEX INTRODUCES HEAVY-DUTY TRIPOD

A new, heavy-duty tripod designed expressly for use with 4 x 5 cameras has been introduced by Graflex, Inc., a subsidiary of General Precision Equipment Corporation. Designated the Graflex Speed-Pro Tripod, the new unit incorporates a specially designed pneumatic device on the 11" extension of the center column which cushions the decent of the tripod head even when weighted with as much as eight pounds or more. Tripod leg

length adjustments are located at the top of each leg for ease of access.

The Speed-Pro Tripod has a maximum height of 68" from a closed length of 34 inches. The two-section legs are 30 inches long, and may be extended 26½ inches more. The top elevation controls allow 70° up and 80° down and operates independent of the 360° rotating control. Lateral tilt control permits 90° right or left, and is secured at increments of approximately 9° via a one-inch diameter knurled lock-head screw. The camera is secured to the 1¾" x 3¾" mounting surface with a camera clamp screw and lock nut on the guide-on adapter.

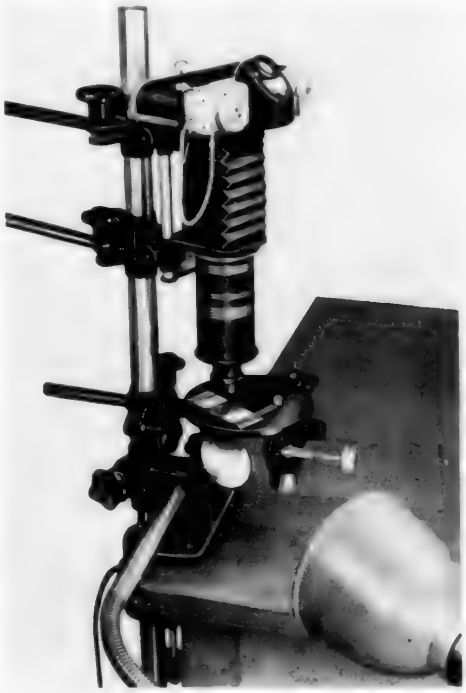
Price of the heavy duty Graflex Speed-Pro Tripod is $44.50.

Further information on the Graflex Speed-Pro Tripod may be obtained by writing to the Advertising Department, Graflex, Inc., Department 121, 3750 Monroe Avenue, Rochester, New York.

25mm ULTRA CLOSE-UP LENS FOR ALPA

The Zeiss Luminar 25mm f/3.5 for the ALPA Swiss 35mm single-lens reflex camera permits extreme close-up photography with subject-to-negative ratios from 1:1 to 10:1 magnification, filling the gap between Macrophotography with the standard 50mm lens (infinity to 3:1 magnification) and Microscopic Photography (7:1 to 1500:1 magnification).

Used with the standard ALPA extension tubes and bellows, the lens provides extremely fine definition across the entire image area, even at full aperture, though it can be stopped down to f/14 for maximum depth-of-field. The diaphragm is graduated such that f/3.5 is marked with 1 and the smaller lens stops with 2, 4, 8 and 15, which gives the exposure factors relative to the largest aperture.



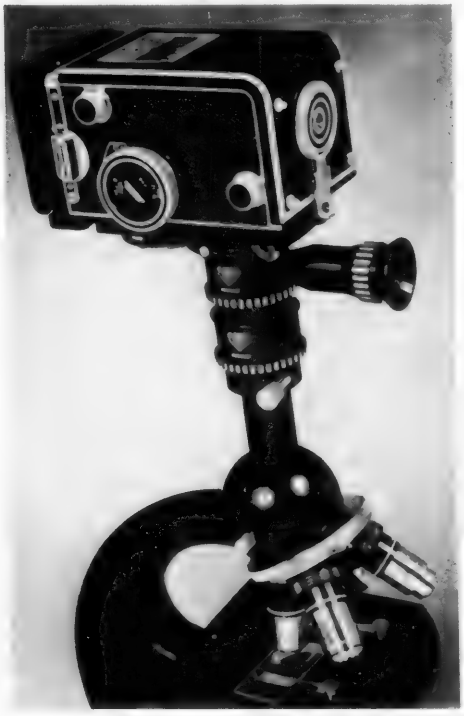
Attached to the flexible ALPA copy and close-up stand with focusable Micro stage, condensor and mirror, the Luminar also permits ultra close-ups with transmitted light.

U.S. Distributor: Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y., through franchised ALPA dealers. The price is $99.00.

ROLLEI MICRO ACCESSORIES

Want to use your Rollei with a microscope? Well, you can now, with the aid of some new accessories made available by Franke & Heidecke, makers of Rolleiflex and Rolleicord cameras.

A Micro Tube, a Micro Prism and some bayonet adapters are the new devices which permit quick, easy, yet precise mounting of



any Rollei camera to any standard (25mm) microscope tube. Viewing may be done in several ways—using the Rollei's own reflex finder, the ground glass back (with plate adapter), or the new right angle Micro Prism. This latter method is the most convenient and permits taking pictures of living, moving objects.

The Micro Tube, with appropriate bayonet adapter (varies with size of bayonet I, II or III) may be used without the Micro Prism, if recourse is had to the first two methods of focusing-shifting from viewing lens to taking lens, or using the ground glass back. In either case only pictures of stable or non-moving objects may be taken.

The complete equipment Micro Tube, Micro Prism and proper bayonet adapter is required for the taking of moving objects, with or without oil immersion. Taking the simpler pictures is also easier with this method since the camera is always ready for the exposure and the subject may be observed at all times, even through the exposure.

These units are finely made, in the true Rollei tradition. Serious clinical and scientific photographers will be delighted with them and even amateurs should enjoy working in this newly opened Rollei photography field.

List Prices

Micro Tube	*$ 9.95*
Micro Prism	*64.95*
Bayonet adapters	*2.00 each*

Burleigh Brooks, Inc., 420 Grand Avenue Englewood, New Jersey.

INEXPENSIVE PHOTOGRAPHIC TIME SWITCH

The new "Mark-Time" clock operated darkroom time switches feature an adjustable stop push-button release and convenient "on-off" switch. A modernistic acid-resistant case houses the clock mechanism, which is powered

by an unbreakable mainspring. The electrical outlet for enlargers, contact printers and photocopiers is conveniently located in the case. The unit accurately times any interval up to 60 seconds—rated at 10 amps—125 V.A.C. U.L. and C.S.A. listed. Attractively priced at $8.95.

For further information, write the manufacturer, M. H. Rhodes, Inc., Hartford 6, Connecticut.

NEW COMPACT WESTON EXPOSURE METER 100 PER CENT MORE SENSITIVE FEATURES ON-OFF POINTER LOCK

The Weston Master IV, a new exposure meter combining the greatest sensitivity and most rugged construction available in a self-contained photographic light meter, has been announced by Weston Instruments Division of Daystrom, Incorporated.

The highly versatile and extremely compact meter is equipped to handle every photo-

graphic assignment for the professional or serious amateur, whether requiring incident light or reflected brightness measurements. Successor to a renowned line of precision light-measuring instruments by a manufacturer with more than 25 years of experience in the field, the new Master IV offers several completely new features:

*1. **100 per cent increase in sensitivity.** The Weston Master IV is 100 per cent more sensitive than its predecessor . . . gives reliable, readable measurements in any usable light condition.*

*2. **Improved acceptance angle.** The acceptance angle of the new Master IV has been greatly narrowed without sacrificing meter sensitivity. Thus the area measured corresponds approximately to the area the camera lens "sees."*

*3. **New simplified exposure dial.** by using only the numbers found on modern cameras, readability has been greatly improved . . . it's more convenient to read settings quickly, accurately. Interchangeability of dials is also provided. ASA exposure index numbers range from .1 to 16,000; shutter speeds from 1/1000 second to 100 seconds. EVS values are direct-reading.*

*4. **On-off pointer lock.** While meter can be used conventionally with free pointer movement, ON-OFF button permits locking pointer when taking incident light readings, in extremely low light locations, or whenever desired. No need to constantly hold finger on button.*

*5. **Rugged, "spring suspended" movement.** Jewel bearings mounted on shock-absorbing springs protect meter from shock damage . . . insure long, accurate life.*

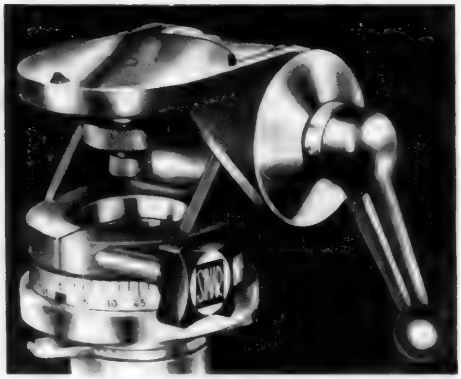
*6. **Converter included for incident light reading.** A new, one-piece, snap-on light converter comes as standard equipment for incident light measurements. It has its own leather case which attaches to the meter-cord or camera strap for carrying convenience.*

*7. **Handy belt-carry case.** A genuine leather case is included with the meter and includes provision for convenient carrying on the user's belt. A snap-on flap allows quick one-hand removal of the meter for use. Weston Instrument Division, Daystrom, Incorporated.*

NEW SINAR PAN-TILT TRIPOD HEAD

This lightweight (2 lbs.), but very sturdy accessory for the SINAR interchangeable 4x5, 5x7, 8x10 (and other) Viewcameras offers extremely easy panning (360°) and tilting (180°) with visible scales, while the SINAR itself can be swiveled more than 180° around its optical bench.

Spring loaded pins, which correspond to the SINAR tripod holder, allowing fast and easy centering of the camera, are automatically depressed when other viewcameras are attach-



ed. Located over the center line of the tripod, the interchangeable (European and American threads) camera screw has coarse and fine adjustments for sockets of viewcameras other than the SINAR.

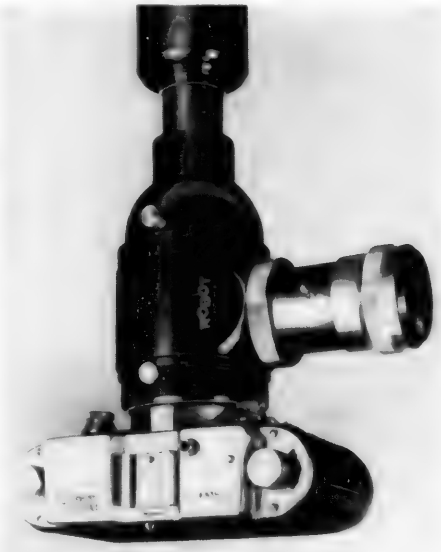
Three point-support assures firm attachment to uneven tripod heads, and a total of 9 breaking surfaces guarantees absolutely firm attachment of any viewcamera, in any position, while the tilt lever also allows partial tightening for later adjustment. Plastic inserts assure both unusually smooth action and positive locking without wear.

U.S. Distributor: Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y., through franchised SINAR dealers. Price $69.90.

ROBOT PROVIDES AUTOMATIC PHOTOMICROGRAPHY

The microscope adapter for the ROBOT ROYAL, Recorder and Star II Automatic 35mm cameras permits photomicrography, either one-by-one shots or entire Kinographic Sequences.

Focusing is done on the centering crosshair of the reflex finder's eyepiece, by using the



fine adjustment of the microscope. No exposure correction factor is required. The price is $129.00. Karl Heitz, Inc., 480 Lexington Ave., New York 17, N. Y.

The following paper will be presented at the First International Congress on Medical Photography, Duesseldorf, Germany September 27-30, 1960:

"Endoscopic Photography in Otolaryngology and Bronchoesophagology"

Paul H. Holinger, M.D. FBPA
Maria E. Ikenberg, FBPA
Joseph D. Brubaker, FBPA.

The paper will be delivered by M. Ikenberg

A film will also be presented at the same meeting:

"Endoscopic Pathology of the Ear, Nose and Throat"
Paul H. Holinger, M.D. FBPA, Kenneth C. Johnston, M.D.
Maria E. Ikenberg, FBPA and James E. Brubaker.
600 feet, color, sound.

NEW MEMBERS MAY, 1960

ALABAMA: *Tuskegee*, Quentin E. Gaillard, V.A. Hospital, Med. Illus. Serv. *Tuskegee*, Carlin P. Graham, V.A. Hospital, Med. Illus. Serv.

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MARYLAND: *Baltimore*, Lan Lovell Robinson, Johns Hopkins Univ., Pathology.

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CUBA: *Havana*, Alfonso L. Fors, Agrupacion Ingenios, O'Reilly 201.

JAPAN: *Tokyo*, Sozo Okada, Tokyo Cinema Co., Inc., Surugadai-2, Kanda.

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JOURNAL BPA OF THE

Biological Photographic Association

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QUARTERLY OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION, INC.

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Photomicrography, The Phase Contrast Procedure

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bio-Graphic Unit, Canada Dept. of Agriculture, Ottawa

THE microscope is perhaps not only the oldest but also the least understood of the various optical instruments used today in the laboratory. In addition, it is frequently the most inefficiently operated and the most abused. This is unfortunate since ignorance of microtechniques can often have far-reaching consequences on visual or photomicrographic work. A correct diagnosis, the discovery of hitherto unknown facts or detail, or the formation of undistorted images for photomicrography can be jeopardized by misuse of the instrument.

The phenomena of vision and photography are based on the ability to distinguish differences of amplitude (brightness) and wavelength (color). Thus, visible images can be obtained only of objects which present either brightness or color contrast, according to whether the amplitude of all light waves has been affected or only some parts of the spectrum absorbed, or both.

The visibility of structural detail in thin translucent micro-specimens depends on their light absorbing ability which changes the intensity or color of the transmitted light. This ability, however, is seldom found in fresh untreated material. Such specimens affect transmitted light so little that the stimulus on the eye is insufficient. Only the phase (the momentary condition of vibration) is altered. The resulting image (phase image) shows in normal bright field illumination no differences in brightness or color between internal structural detail of the object and its surroundings. Early microscopists devised means to overcome this difficulty. they developed methods by which different dyes could be introduced into the specimen and thus convert the flat, poorly defined and poorly contrasted "phase image" into an "absorption image" rich in the desired black and white or color contrast. Today a whole new science — stain technology — has been built on these early principles of biological staining.

Regardless of the quality of the optical system, preparations of low contrast do not allow observation of structural detail with a conventional microscope. Biological fixing and staining techniques may prove to be a risky operation, as this process can change the morphological detail in an uncontrollable manner and the specimen may not survive such a treatment.

In the early thirties, the Dutch physicist, Fritz Zernike, devoted much of his creative genius to research of light waves passing through unstained non-absorbing objects. In the course of his work he observed that the progress of a light wave can be delayed, without any appreciable change of amplitude or

wave length, while passing through certain substances, thus causing phase differences. This phenomenon pertained to most thin, transparent micro-specimens. Later on, Zernike devised a procedure by which the invisible phase differences could be transformed into visible absorption images. In 1953, Zernike was awarded the Nobel Prize for this important contribution to the art of light microscopy.

August Koehler (whose name has become a by-word in microscopy through the development of a theory of illumination), in co-operation with Walter Loos, perfected Zernike's method for practical application. The first phase contrast microscope was ready for manufacture in 1941.

Frequently, biological specimens have to be inspected or photographed in a living, untreated condition. Phase contrast permits the study of morphology in living microorganisms. Instead of drawing conclusions from disconnected individual images, we may now observe and record continuous growth. This can be evaluated particularly well in cinemicrography, and we can now produce excellent movies of growth processes which in bright field are not even visible to the eye. Growth, cell division, colony formation, reactions to the influences of nutrient media and toxic materials, the movements of microbes, etc., can now be successfully recorded by means of time-lapse, slow-motion or normal-speed movies. (Fig. 1)

Today, phase contrast equipment is built by every major microscope manufacturer and it is gaining in popularity in every branch of biological science. The manufacturers conduct further research to improve their versions of the system and the biologist finds new uses for it. Phase contrast has been used to show numerous morphological qualities that become lost in fixed and colored preparations. In cytology, the phase contrast microscope has contributed

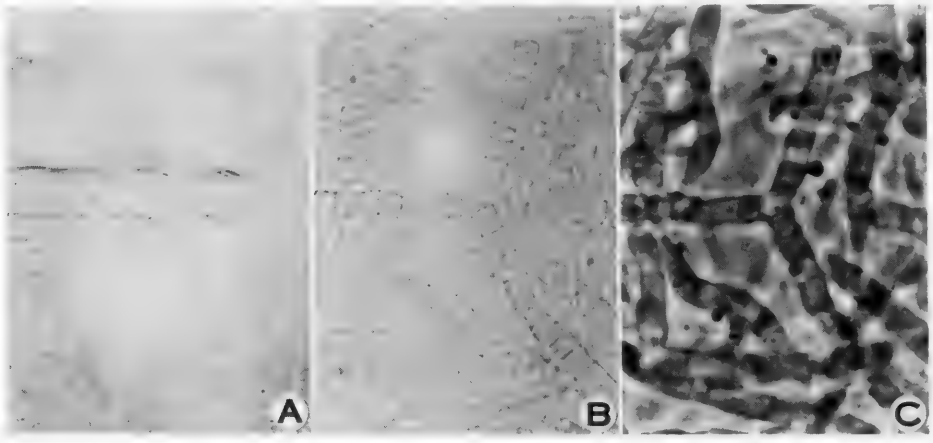


Figure 1. *SPORENDONEMA SP:* CONIDIA ALTERNATING WITH EMPTY CELLS

A good example of phase contrast application. (A) Bright field with properly adjusted condenser diaphragm. (B) Bright field with condenser diaphragm closed down to minimum opening. This operation increased contrast very little but decreased resolution considerably. (C) Same field taken with phase contrast. This operation increased contrast considerably and retained a high resolution

considerably towards extending scientific knowledge and simplifying practical diagnostics. There are striking results with phase microscopy in all branches of biology and medicine and in many of the technical sciences.

The phase contrast method renders excellent service in photomicrography. In some instances, even stained bacteria are more easily seen under phase contrast than in bright field. This is particularly true in showing tubercle bacilli in sputum or gastric juice. Where phase contrast equipment is not available, bright field contrast can be increased slightly by closing the condenser diaphragm past the optimum for the objective. This technique, however, will decrease the effective N. A. and thus diminish resolution and image formation. Invention of phase contrast does not make the bright field system obsolete. The best images are still obtained with bright field, provided the material is properly prepared.

Any material which shows polarization colors between crossed Nicol prisms or polarizing filters is anisotropic. Anisotropic substances possess birefringence which means that they polarize light in two directions at right angles to each other. The two light rays travel at different velocities through the crystals. Thus the crystal exhibits two refractive indices. Opposed to anisotropic, is isotropic; indicating that the substance has no polarization effect on light and remains dark between crossed Nicols.

Many micro preparations contain birefringent material. To demonstrate anisotropy, to locate the position of the optical axis, and to determine the extent of double refraction, a polarizing attachment can be used. This will convert the instrument to a polarizing phase microscope. When the planes of vibration of the polarizer and analyzer are at right angles, double refracting material in the tissue preparation will appear bright. However, single refracting material is then somewhat difficult to see. This situation can be remedied by use of a first order red plate or any other suitable compensator in conjunction with the analyzer. (Fig. 2)

Some spectacular results can be achieved by using cellophane as the compensator. Depending on its thickness, cellophane has the ability to retard certain wavelengths and let others pass. If the microscope is equipped with a rotating stage, double refracting material will change in color from blue to red or vice versa on rotation of the stage. This technique can be used with any anisotropic material but it is only suitable for qualitative analysis. If it is necessary to measure the anisotropy phenomenon, then the combination of phase contrast and the polarizing attachment is no longer sufficient. Quantitative analysis must be done with a special polarizing microscope.

Zernike's phase contrast principle has been used by various manufacturers in various ways. Today there is a great variety of phase contrast objectives and condensers available. All phase contrast optics require the same degree of correction for chromatic and spherical aberrations and for reflection as those for the conventional bright field. The phase contrast objectives can be either achromatic, fluorite or apochromatic and they are made for dry or immersion systems. To suit individual purposes, they are also manufactured for positive or negative phase contrast as well as with a normal (about 75%) or high (about 88%) absorbtion. The high absorption objectives should be

used in instances where the difference in refractive index between the structure and the surrounding medium is particularly small. For example, when using objectives with normal absorption, the mitochondria in tissue cultures appear pale, although the resolution is good, whereas with high absorption objectives they stand out much more clearly. Phase contrast objectives, if used with a conventional condenser, can serve for bright field work at a slightly reduced Numerical Aperture.

There is little if any difference, apart from the previously described characteristics, between the phase contrast objectives available from the leading optical manufacturers. They all build normal and special purpose equipment, such as negative high absorption, etc., and the choice will usually be governed by the make of microscope stand already possessed. Phase contrast condensers are available in two different types; a rotating condenser with a preset click-in position for each objective and a "rack and pinion" type which has to be adjusted up or down for each objective. Most of the better condensers also have a bright and a dark field position, as well as such other refinements as adjustable working distances to accommodate thick specimens or specimens in deep containers, color phase contrast, etc. The particular feature of the Leitz Heine condenser, for instance, is the unique device which permits continuous observation of the specimen during changes between phase contrast, dark field and bright field. There are few specimens which contain phase objects only. Phase structures are usually intermingled with absorption structures and other detail which perhaps appears more clearly in dark field. Using the rack and pinion of the Heine condenser it is possible to see changes of images from one method of illumination to the other as well as all in-between stages. Thus, it offers a greater variety of illuminations, but requires manipulation; pre-set "nose piece" type condensers are frequently preferred for ease of operation. The rotating "nose

→

Figure 2. ANISOTROPY IN A BIOLOGICAL SPECIMEN
(Aphaereta Pallipes, Sodium Rhodizonate Stain)

(A) Bright Field: Meconium is well differentiated. Birefringent material, however, cannot be identified as such and larva gut cells, adult gut cells, fat bodies and adult body wall are not visible due to insufficient difference in refractive index.

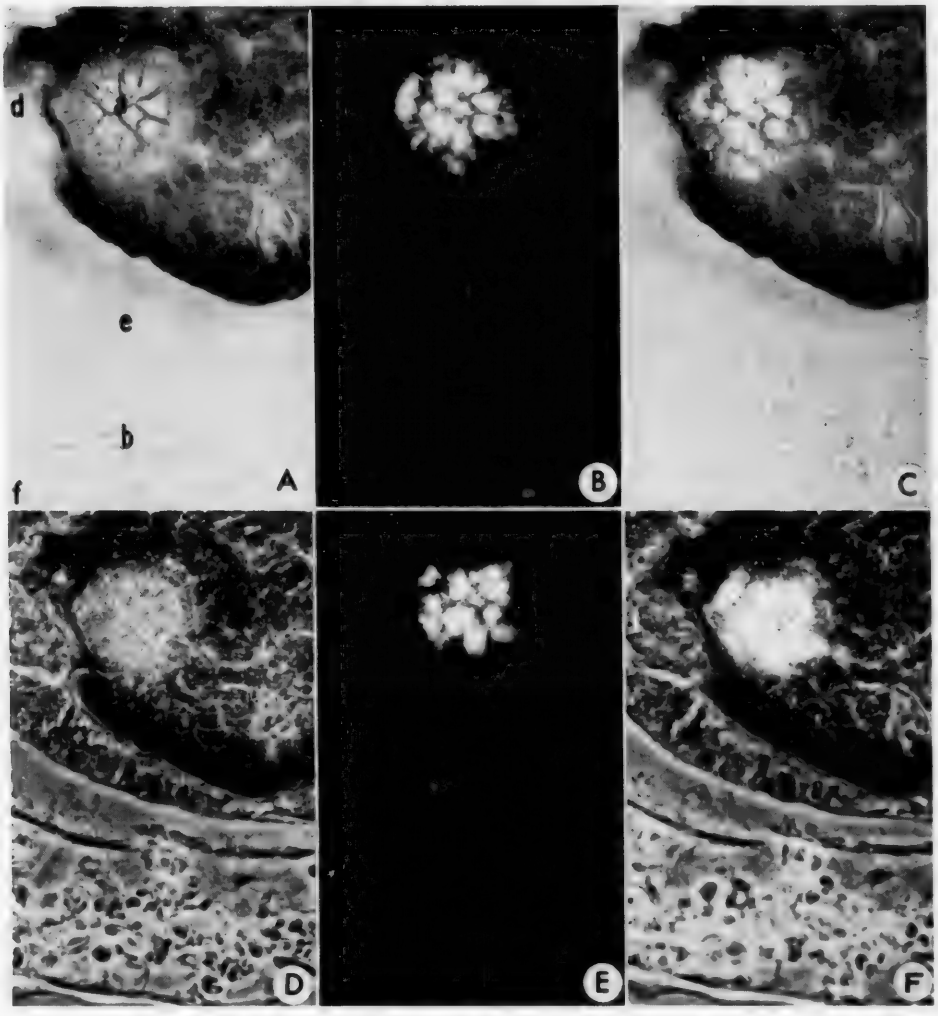
(B) Polarized Bright Field: Identifies birefringent material but blacks out all related isoptropic matter.

(C) Polarized Bright Field Through a First Order Red Plate: Identifies birefringent material in relation to isotropic surroundings. Phase images remain indistinct as in (A).

(D) Phase Contrast Image: Shows much more detail than the regular bright field image (A); birefringent material, however, cannot be identified as such.

(E) Polarized Phase Contrast: Only the birefringent material is evident and the isotropic surroundings are completely blacked out as in polarized bright field (B).

(F) Polarized Phase Contrast Through a First Order Red Plate: Shows all the detail of regular phase contrast and identifies birefringent material (superior to similar image in bright field — (C)).



Legend: a. birefringent material in meconium; b. fat bodies; c. waste material; d. larval gut cells; e. adult gut cells; f. adult body wall.

piece" type phase contrast condensers give a quicker and more positive selection of the proper setting for each objective and each type of illumination but they black out the images during changes and deprive the microscopist of the benefit of continuous observation and of the frequently useful intermediate settings.

Specimens with phase and absorption structure, examined with phase contrast, will show striking and perhaps undesirable halo effects; particularly around the absorption structure. This phenomenon is due to exaggerated differences in the refractive index resulting from the use of phase contrast. (Fig. 3)

Not every specimen requires phase contrast microscopy, but on the other hand, there are more situations than we realize in which a phase contrast microscope can be used. The Photomicrography Section of the bio-Graphic Unit employs Leitz Phase Contrast equipment with a Heine Color Phase Contrast Condenser. The particular feature of this set-up is the versatility and variety of lighting effects it offers. Besides the standard phase contrast, dark and bright field anisotropic material can be observed and photographed by means of the built-in polarizing and compensator filters. Color effects in isotropic material can be achieved with the built-in color discs. All these special effects can be applied either to the regular phase contrast or to a dark field position.

Photomicrography with phase contrast poses several minor problems but on the whole, it does not differ much from bright field work. In general, greater contrast is required for photographic purposes than for visual observation. Images seen through a microscope do not necessarily reproduce equally well on photographic emulsions.

Due to the various light interception devices of the phase contrast procedure, there will be a considerable loss of light which necessitates prolonged ex-

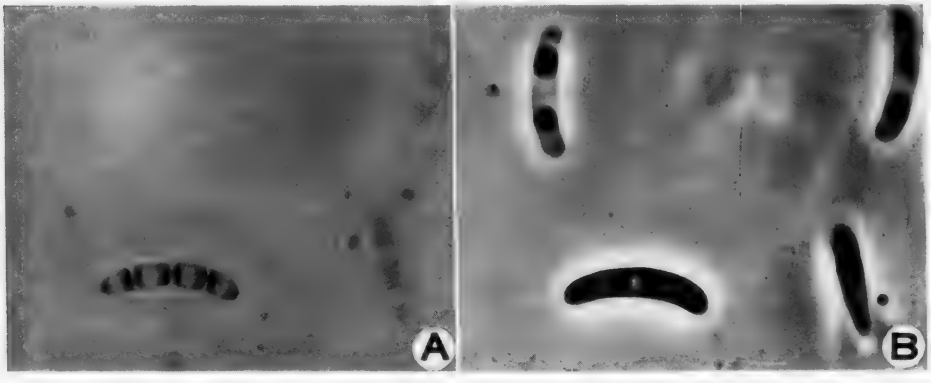


Figure 3. *MENISPORA TORTUOSA*: FINE HYALINE APPENDAGES ON CONIDIA

Another good example of phase contrast application. (A) Bright field with properly adjusted condenser diaphragm. Note that only the one old conidia with heavy walls is visible. (B) Same field taken with phase contrast. Note how young, thin-walled, conidia showed up. Fine hyaline appendages became visible on the old conidia. Also note the varying halo effects; old conidia with greater original absorption shows stronger halo than the young ones.

posures. On color emulsions, phase contrast photomicrographs have the tendency to shift color rendition towards the blue. But since there are seldom any colors present in the specimen, most of the work will be carried out with black and white emulsions. The use of a green Wratten filter, such as B-58 (exposure factor X5), will further increase contrast and improve the resolution, particularly if achromatic objectives are used. In extreme cases of contrast deficiency, considerable improvement can be achieved by using process films. If these means fail, a special mounting medium with a lower or higher refractive index than that customarily used, can be tried. A set of such media with n -1.515 and 1.525 for dehydrated specimens (Canada Balsam, n -1.535) or n -1.515 for aqueous specimens (water n -1.333) is supplied by Carl Zeiss.

If a photometer is used, the reading taken either from the focusing screen or from any other point of the light path, such as the ocular position, might give misleading results; particularly in polarized phase contrast or dark field. In the case of polarized light, the photometer reading might be too high, whereas dark field readings might be too low, resulting in under or overexposure. A compensation may therefore be necessary.

Phototechnique:

All photomicrographs were exposed on Kodak Panatomic — x film 3¼ x 4¼ and printed for reproduction on Kodabromide F2 paper. The photomicrography set-up used for this work was Leitz Panshot with Phase Contrast and Bright Field objectives (Pv Apo Oil, X90, A=1,15; Pv Apo, X40, A=0,70; 4 m/m Apo, X40, A=0,95) X10 Ocular and 35 cm bellows extension. For Phase Contrast a HEINE Color Condenser and for Bright Field a Two-Diaphragm A=0,95 Abbe Condenser were used. For illumination a 40 watt zirconarc was used, with an average exposure time of 37½ seconds.

Postgraduate Medical Education By Broadcast TV Is Demonstrated

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COUNCIL ON MEDICAL TELEVISION

One of the hightlights of the second meeting of the Council on Medical Television, held at the National Institutes of Health on April 20 and 21, was the section on "Prepared Teaching Presentations" — postgraduate education for the general practitioner which had been prerecorded on film and Videotape — the latter employing an Ampex Videotape recorder and an Eidophor large screen TV projector.

Using Videotape recordings, the contents of which were designed for open-circuit TV transmission, Dr. C. Hilmon Castle, University of Utah, and Dr. Frank M. Woolsey, Albany Medical College, demonstrated the potentials of this medium for supplementing the continuing education of the practitioner. Dr. Castle had tested a group of Utah physicians and students both before and after an 8 week televised course on the "Diagnosis and Treatment of Diabetes Mellitus," shown originally over KUED-TV, the University's ETV station from February 16 to April 12, 1960. The post-program test results were significantly higher than the pre-program averages. Dr. Woolsey supplemented his 30 minute Videotape on the "Treatment of Peptic Ulcers" with an audio recording taken from a 2-way FM radio hook-up between 6 hospitals. This "round-robin" audio system enabled physicians assembled at these hospitals to ask questions of program participants immediately after the telecast concluded. Other physicians could hear the question and answer session in their homes by tuning to the proper FM frequency.

Dr. Leo L. Leveridge, Coordinator of the N.Y.U. — Bellevue Medical TV Unit showed samples of 3 different approaches to the production of TV films for postgraduate education. These segments were chosen from 3 films already completed. The examples ranged from essentially verbal to precominantly visual. These programs are intended also to give the faculty experience in teaching with TV and to guide the evolution of the series.

One of the most important factors discussed is conjunction with all 3 presentations was the relationship between production costs, faculty time spent in program preparation, and program effectiveness. There was little, if any, controversy about "side effects" that might be experienced by incidental lay viewers. It was generally agreed that, presuming thoughtful program preparation, fears of offending the public are overemphasized. This was in marked contrast to the opinions expressed at the first meeting of the Council last October during which discussants did not have an opportunity to see actual examples of open-circuit programming. In certain instances, such as the excerpt from the TV film on "Self-Help Devices for Patients with Arthritis," introduced by Dr. Howard Rusk, it was pointed out that the public could benefit from viewing such a telecast. Although coded or "scrambled" TV transmission is ultimately desirable, these presentations proved that much can be accomplished by employing standard television facilities.

According to John Mackenzie, Executive Secretary of the Council, plans are being made to encourage other medical schools to begin prerecording postgraduate courses in order that a reciprocal exchange program between schools can be initiated. The Council is an activity of the Institute for Advancement of Medical Communication in New York, Richard H. Orr, M.D., Executive Director.

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Camera Attachment for Photography of Oscilloscope Traces

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THE following combination of units has been found reliable as a relatively inexpensive assembly for taking photographs of cathode ray oscillograph figures, at the usual range of sweep speeds.

As Figure 1 shows, the device consists of the Galileo 4-legged stand for taking close-up photographs, using the Condor I 35 mm. camera with portrait lens, F=20 cm. A large central hole was cut out of a square brass plate, 1/8" thick (Figure 2) to fit over the bezel of the 5" cathode ray tube, of the Tektronix Type 532 cathode ray oscillograph. Four small peripheral holes, A, B, C, D, 7/16" diameter, 5" between hole centers, drilled into the brass plate, enable attachment to the oscilloscope housing, while 4 slots cut into 2 edges of the plate are for accepting the legs of the stand, which is thus used in a fixed horizontal, instead of the customary vertical position. Numerous clear photographs have been taken with Kodak Plus X and Tri X film of scope traces of varying degrees of complexity.

The advantages of the instrument are: (1) the adapter can be attached or dismounted by means of the knurled nuts

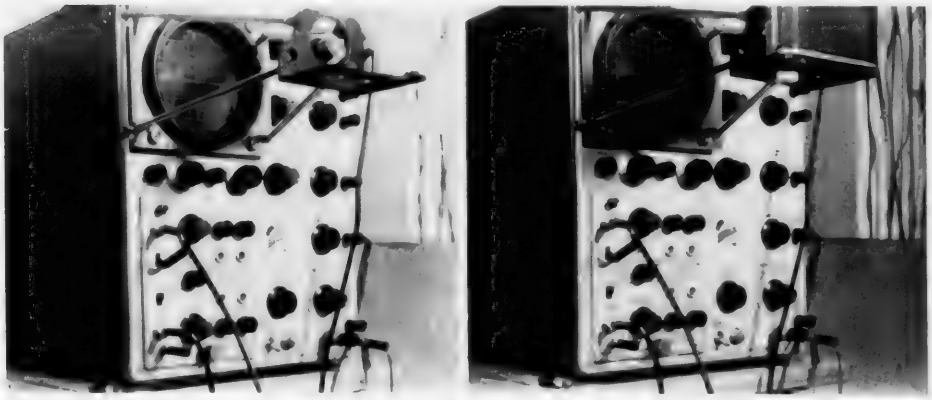

Figure 1. A. Stand held in place horizontally by brass adapter plate.
B. Camera attached to stand.

*Aided by Grant B-1657 of the National Institutes of Health, Bethesda, Md.

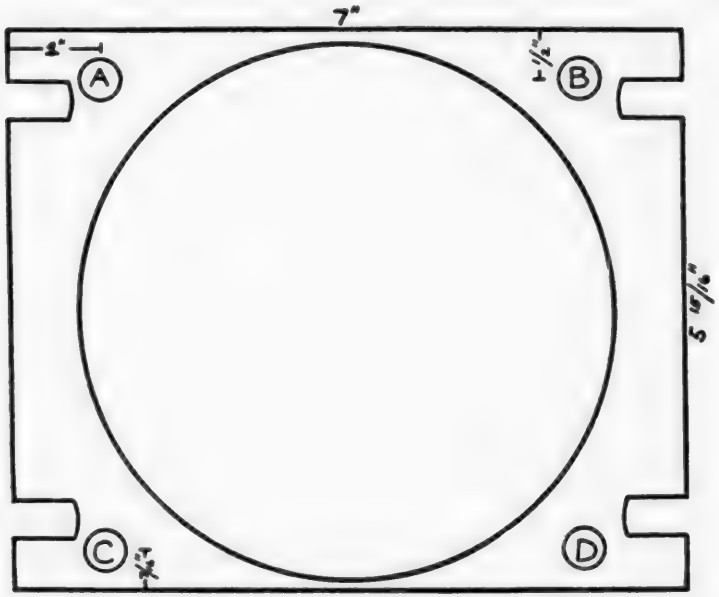

Figure 2. Dimensions of brass plate adapter.

at holes A to D. (2) The oscilloscope traces to be photographed are visible during photography and can be viewed from several angles. This enables one to manipulate other apparatus in the room and both observe and photograph the result on the oscilloscope screen without keeping the head fixed at the eyepiece as in the case of the totally enclosed type of oscilloscope camera. (3) The camera itself can be disconnected readily, and used for any other routine work. (4) The attachment is light but rigid. (5) The cost is low.

The disadvantages are: (1) Substantial darkening of the room is desirable, which disadvantage is countervailed by the aforementioned advantage no. 2. Moreover, one could in an illuminated room throw a black cloth over the instrument while snapping the picture. (2) If the oscilloscope available does not have 4 mounting screws, these would have to be drilled into the front of the case, near the bezel.

Stand and camera are available from the Galileo Corp. of America, 30 E. 60 St., New York, N. Y. Any other similar combination of camera and stand could be adapted for the same application.

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Lights and Lighting

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THIS paper will discuss the several forms light may take in clinical biophotography of patients. First, a general statement of what kinds of artificial light are available: The carbon arc in the early days of photography was the only high intensity artificial light available. It is used today only in some photomicrographic equipment and for projection over long distances in very large amphitheaters. Many years ago the mercury vapor tube was used quite extensively in photography, but as it has a discontinuous spectrum and is deficient in red, it was discarded. It is also bulky and hard to move about. About this time the incandescent lamp appeared in an improved form, with more powerful output of light than had hitherto been considered possible. While the spectrum of incandescent light is not that of daylight, it serves very well as a substitute. Today we have this light in many different sizes, shapes, and output of light.

In recent years the fluorescent tube has been developed. This is a cold light and would seem the answer to some of the biophotographers' problems, such as glare and heat. Unfortunately it is a highly diffuse light form, consequently, aside from use as a copying light, the biophotographer seldom uses this otherwise desirable light form.

Another light is the flash lamp. It has a place, but the biophotographer suffers from the fact that he does not know where the shadows will fall on the subject, unless an incandescent light is set up and the flash lamp substituted just before the exposure. This is a time consuming method that is seldom employed. It adds materially to the cost per patient as it is used but once. It is not safe to use in the operating room without a shield over the reflector, to prevent accidents from bursting flash bulbs. This is rare but can happen. Also there is some danger of a spark from the switch when the lamp is fired. It is excellent when used for color and for public relations photography.

Electronic flash is being used with greater frequency in biophotography. This type of flash can be used many hundred times before it needs replacing. It suffers from the drawbacks of straight flash, not knowing where shadows will fall, although some electronic flash tubes have a focusing lamp incorporated in the reflector, which is of some help. Electronic flash should never be used in the operating room unless the equipment has been approved by the Underwriters, as there is danger of sparking in some equipment. This type of light operates on high voltage. The studio type of equipment has wire from the condenser bank to the flash tube to the shutter, which is hazardous to patients from a standpoint of tripping, etc. Most of the portable electronic

flash are quite compact and are battery operated, but a few do not have the output of light necessary for color photography on sheet film. Electronic flash is of particular value in photographing patients with photophobia and those nervous patients who just cannot remain still. It has a useful place in biophotography, particularly when focusing lamps are incorporated in the reflector.

The photoflood lamp is widely used for all types of photography. It comes in several sizes in the regular form and also as a self-reflecting flood type and as a self-reflecting spotlight. The photoflood lamp is less expensive and is commonly used in inexpensive reflectors, which makes it popular for the amateur photographer. It has a frosted shell that produces a soft, diffuse light which is fine for portraiture but which has several disadvantages for biophotography, especially specimen and patient photography. What is needed for these purposes is a hard light for reasons which will be apparent later in this paper. The life of the photoflood lamp is from two to six hours of burning. During this time the Kelvin temperature is constantly changing which makes it difficult to make a series of color shots having the same average color. If a great deal of photography is done, the photoflood is not an economy, as the lamps must be changed frequently, often daily. This amounts to a fair sum of money in the course of a month.

For the best results obtainable, it is the writer's considered opinion that the incandescent lamp with clear glass shell presents the best medium for the production of consistently good medical photographs. The incandescent lamp, unfrosted, that is with a clear glass shell, in a well designed reflector, produces a semi-hard light which is excellent for modeling. If a greater hardness is wanted, a reflector can be used which has a fresnel lens at the outer end. If the maximum of hard light is needed, then a *true* spotlight must be used. A true spotlight has its own condensing system with a means of focusing the light with a projection lens. In other words, it produces collimated light. Many reflectors for use in photography are called spot lights but are not true spots, there being only a method of concentrating the light beam, but no collimation. The most useful incandescent lamps for biophotography are the 500 watt, 750 watt and 1,000 watt. The 500 watt lamp can be used for copying and for specimen work, and the 750 and 1,000 watt for living subjects. All of these lamps must be used with some sort of reflector, and it must be a reflector designed for that particular shape and size of lamp if the greatest efficiency is to be obtained from the lamp. Avoid the home made reflector, it seldom does anything except confine the light. It does not amplify or produce an even light. It is most inefficient and should have no place in a professional laboratory. Even those reflectors made for professional use need to be selected with care. Bear in mind what you wish to use the reflector for. Is the light to be close to the subject (three or four feet)? Is the subject large or small? Some reflectors produce a fine even light at a distance of five or six feet, but when moved closer to the subject they develop a hot spot in the center of the light beam. If the area to be photographed is very great, it is impossible to light a large surface evenly with the lamps up close. It is frequently not possible to give a sufficiently short exposure with the lights six feet away,

where the light is even. You can either increase the power of the lamp, which will probably cause a hot spot at six feet, or buy reflectors for your lamps which will give an even light at the distance you use. This should always be kept in mind when buying lighting equipment. The foregoing in regard to evenness of light at varying distances, is more true of open face reflectors than those with fresnel lenses.

We have not mentioned daylight as a light source. It is not good because it constantly varies in intensity from minute to minute, is not available at night, cannot be picked up and placed where it is needed, and is generally useless for the biophotographer indoors. It seems to be very popular when used outdoors.

Let us discuss how these lights can best be used in biophotography. First let us clear up the matter of shadows and where they belong. Shadows in nature always fall down or to one side. They *never* fall *up*, but that is where one often finds them in medical photographs. For general purposes, the lights should always be higher than the patient's head and should fall at about 45° on the patient. This holds true particularly for the modeling light, the fill-in light can be lower and at some other angle. The modeling light will kill any shadow trying to fall up. Shadows on top of shoulders or on top of the clavicle or collar bone are very bad. The placement of shadows is of the greatest importance if the best possible picture of your subject is to be obtained. Each patient is a separate lighting problem. In general there must be a similarity of lighting on all patients with the same diagnosis, but for the best results there can be no such thing as a standard lighting for any subject. *Light for the individual patient.*

Study the effect of incandescent light on the human anatomy at every opportunity, at home, the movies, wherever you are, and observe where the light source is and how it acts in modeling the face or hands. *Remember all your professional career that your job is to photograph the texture of the surface of the patient.* If you will remember this and will seize every opportunity to practice the use of light in registering the texture of any object, you will succeed in being a good biophotographer.

Now let us take up the types of lighting that may be used. Broadly speaking, there are two basic types of lighting, flat, and modeling or texture lighting. The poorest, and the one which should be used the least, is true flat lighting. It is the lazy way of lighting patients because you get a photograph that appears usable without having to do any thinking, but is rarely the best lighting for the subject. Many people who say they use flat lighting do not do so at all, but use a watered down version of 45° lighting. True flat lighting means placing the lights at the level of the lens and as close to the camera as possible. Both lights are on the same level. Doing this you make a photograph that contains almost no shadow, with a consequent lack of modeling, so that form is lost. Without a modeling light there can be no idea of true form. Most individuals who say they use flat light do all the above except that they raise both lights about two feet above the lens. This helps some, but still does not convey a real idea of the appearance of the patient.

Before any more is said about the use of lights, let us consider the use of reflectors. Many biophotographers use two lights consistently while quite often

one light and the proper reflector would make a better photograph. Consider the kind of reflector you should use. Crinkled foil, smoothed out and glued to compo board is ideal for hard, contrasty reflection. White cardboard reflects a softer light. We use reflectors of all kinds and have them in many sizes from little white cards, one by six inches, to three by five foot crinkled foil reflectors on stands. Light can be bounced into shadows and the depth controlled by using reflectors at varying distances from the subject. Flat mirrors of various sizes are occasionally of value for hard reflections. Sometimes curved circular mirrors similar to the common head mirror can project a small beam of light into a cavity where the main light casts nothing but a shadow.

Now let us go over the various ways in which we can use modeling or texture lighting. There is back light, top light, bottom light, side light all the way from 0° at the camera to 89° at the subject. All these are done with one light, but this is the modeling light. Now you will have large areas of shadow to overcome so you will place a fill-in light nearer the camera to fill these shadows with some light. The placing of the fill-in light must be done with care or the effect of the modeling light will be overcome. Remember the inverse square law in regard to light. The intensity of light received at a point varies inversely as the square of the distance from the source. Use of an incident light meter at this point will bring out the inverse square law very clearly. Most biophotographs are made on a lighting ratio of two to one, that is, the highlights or modeling light is twice the meter reading of the shadows. Now measure the distance from the modeling light and the fill-in light to the camera and note that the fill-in light is not twice the distance from the camera. The use of the incident light type of meter is recommended when methods of lighting are being studied. The two to one ratio of highlight to shadow is about the right contrast for most medical subjects. As experience is gained in lighting, it will not be necessary to use the meter on every patient, as the biophotographer will be able to "read" the shadows in relation to the highlight areas.

In lighting a patient, the first light set up is usually the modeling light, then the fill-in light is placed where necessary to get light into the shadows. This is done much more easily on close-up views or half figures than on full length figures, because of the greater ease of controlling light on fairly small areas. Do not hesitate to make use of reflectors in addition to the two lights. They will often do the trick where a third light added would overlap or confuse the picture by putting more shadows in all the wrong places.

Best results in full, half-length, and head pictures will be obtained if a back light on the head and shoulders is used. The lighting of full length figures with two lights presents some problems not present in lighting smaller areas. It is still necessary to use a modeling light in order to show surface texture, but this light will fall off badly at about waist height. The fill-in light must be placed low, usually at slightly below waist level, in order to light the legs enough to balance the negative. This is where the trouble starts, as there is a tendency to overlight at this point and thus destroy the modeling given by the modeling light. A little practice will show where the fill-in light must be

placed. Patients lying flat can be lighted from the same angles as though they were erect by placing the lights at the head of the patient and at the same angle which would be used on a standing figure. This is a point often ignored in recumbent figures with attendant poor results from a lighting standpoint. Close-ups of patients with any irregular body surface from large tumors to small skin eruptions should be lighted from the top or side so that shadows will be cast. Fill-in light should be used.

Just a word on exposure. Remember that the more light that is introduced, the shorter the exposure will be, and the shorter the exposure the greater sharpness. Prove this for yourself by shooting a standing figure at 1/5 second and again at 1/50 second and compare them for sharpness. Many biophotographers are afraid to use lamps of 1,000 watts and a short exposure. Try it and you will find no more complaints from patients than you did when using 500 watt lamps and your exposure will be much less. On the diaphragm opening to use, just enough to get sharpness from front to back of the subject. This will vary with the focal length of the lens.

Watch the cables for your lights and see to it that the extra coil of wire is kept well to one side. Be sure that the lamp tripod is sturdy and not top heavy so that the hot lamp will not topple over on the patient. Make sure you have a nurse or attendant with the patient to help in any way necessary, do not try to work alone with a patient.

AMA Awards for Photography

The American Medical Association at its 109th annual meeting in Miami Beach, Florida, June 13-17, 1960 made two awards for photography appearing in the scientific exhibits.

A Certificate of Merit was awarded to Alex Gravesen, Peter B. Werner and Howard Murphy of the Veterans Administration Hospital, Memphis, Tennessee, for the photography in an exhibit entitled "Cancer Cell Detection by Millipore Technique". The authors of this exhibit were Drs. Herman Bernhardt, Joseph M. Young and Robert Gourley.

This was an attractively designed exhibit that contained color transparencies of very good quality. The legends for the transparencies were negative transparencies that were dyed so the lettering appeared in color on a black background. Some of the transparencies of graphic material appeared to be made on colored diazo film.

Honorable Mention was given to George Buchanan of the Lahey Clinic, Boston, Mass. His photography appeard in an exhibit entitled "Esophageal Diverticulum" that had been prepared for Drs. David P. Boyd and Robert E. Wise.

This was an attractive exhibit that was simple in design. A center panel contained color transparencies of very good quality. Two side panels contained monochrome transparencies that had been toned blue. The legends were black letters on white paper.

There were other exhibits that contained a number of photographs of good quality but the same exhibits also contained a number of photographs having poor quality so they were eliminated from consideration. Several other exhibits containing good photographs were not judged because the photographs had been collected from a number of sources and the names of the photographers could not be ascertained.

The judging committee consisting of Leonard A. Julin, Chairman, William J. Taylor and Thomas J. Lannon viewed 290 scientific exhibits in reaching their decision. The exhibits this year contained considerably fewer photographs than in previous years. Probably this was due to the fact that many of the scientific exhibits had been constructed by commercial firms that prepare industrial exhibits. The result was that these exhibits had elaborate modernistic cutouts consisting of plastics and plywood. Much of the reading matter had been done by sign painters or consisted of colored plastic letters. This attracted attention to the design of the exhibits rather than to their content. A number of persons were heard to ask if these were commercial exhibits. More than one physician was heard to complain about this confusion so perhaps the trend will return to more conservative presentation of scientific data.

LEONARD A. JULIN
June 30, 1960

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The LogEtronic Enlarger in Neuroradiology

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Introduction

THE medical-photography literature contains a large amount of information on methods aiming to obtain "facsimile" reproductions of X-ray films[1,2,3]. Excellent results have been achieved with these methods, which however have one common drawback; they are very time consuming. The development of electronic equipment such as the "LogEtron" has to a large extent simplified the task of making reproductions of X-ray films and made it possible to bring out information contained in the original film, which in some cases could not be seen in reproductions made with optical methods[4].

A LogEtronic contact printer and a LogEtronic enlarger are available. The aim of this paper is to demonstrate that the LogEtronic enlarger may, with certain modifications, be used not only for enlargement purposes but also to make actual (1:1) size reproductions of X-ray films. This is possible when the area of interest of the X-ray film does not exceed a maximum of 4 x 4 inches. In neuroradiology the areas of interest in the radiograms are generally small, and quite frequently thick and dense areas alternate with thin and light areas. In addition, the contrast media used (air, Diotrast, Pantopaque) for the various neuroradiological procedures enhance the contrast-difference of the various elements represented in the radiograms. These two factors, the small size of the areas of interest and the marked contrast difference, generally present in these radiograms, represent the circumstances which make possible and practical the use of the LogEtronic enlarger in neuroradiology.

The LogEtronic Enlarger

The main features of the LogEtronic enlarger have been described[5]. These features are schematically represented in Figure 1. The LogEtronic enlarger differs from the conventional enlarger in having a cathode ray tube (CRT) as a light source. A small scanning beam of light travels across the face of the CRT, this beam being continuously modulated in intensity according to the varying densities in the X-ray film put in the negative carrier of the enlarger. The degree of modulation of the scanning beam is further controlled by the selection of the position of the dodging control knob. A beam-splitter, located between the negative and the enlarger lens, diverts 8 per cent of the scanning light to a phototube. This phototube acts as a "governor" and produces the electrical control which brings about the modulation of the scanning beam. The dodging may be compared with "unsharp masking" used in optical reproduction meth-

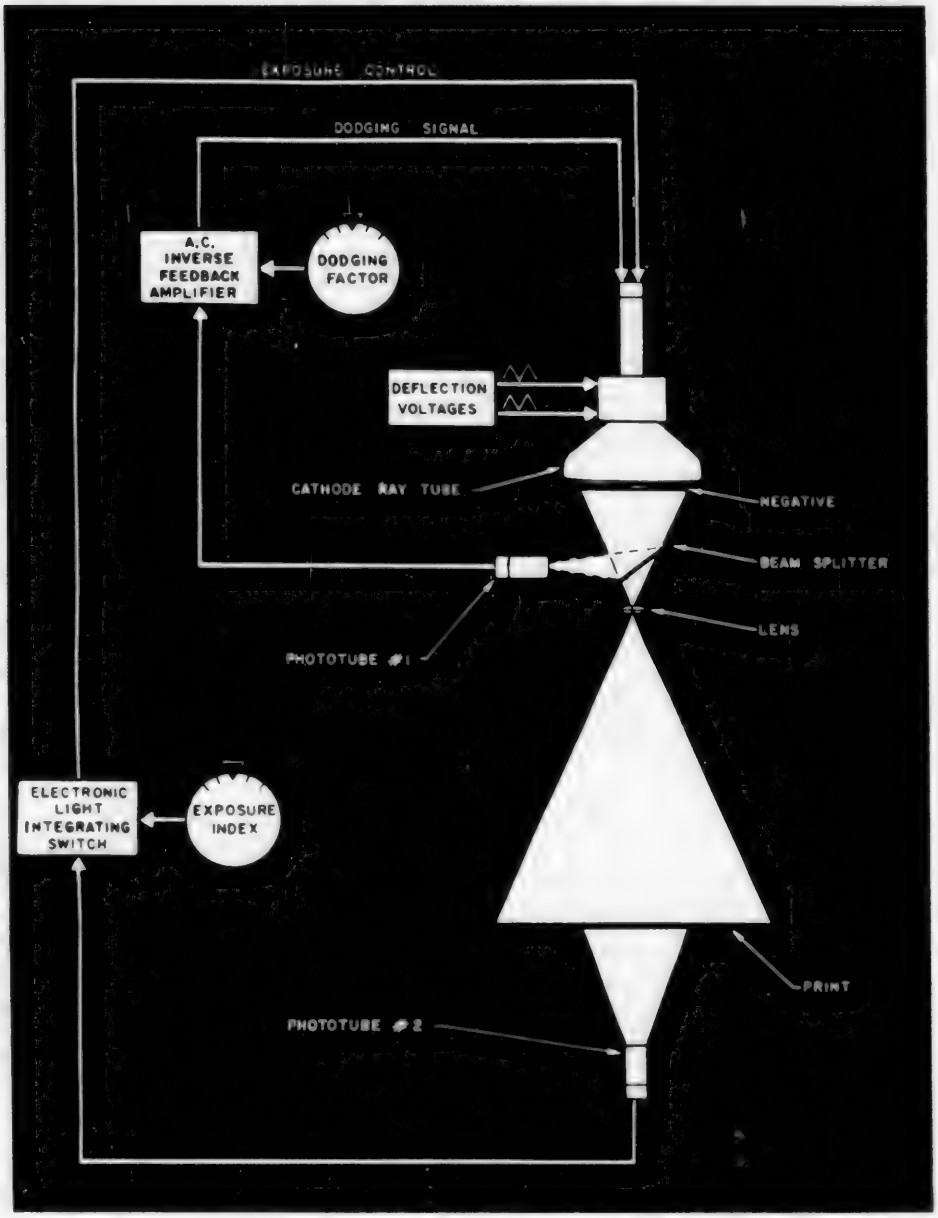
EXPOSURE CONTROL
DODGING SIGNAL
A.C. INVERSE FEEDBACK AMPLIFIER
DODGING FACTOR
DEFLECTION VOLTAGES
CATHODE RAY TUBE
NEGATIVE
BEAM SPLITTER
LENS
PHOTOTUBE #1
ELECTRONIC LIGHT INTEGRATING SWITCH
EXPOSURE INDEX
PRINT
PHOTOTUBE #2

Figure 1

ods. The over-all density range of the original is brought within the emulsion scale of the intermediate: detail-contrast is consequently increased. There are eleven positions on the dodging control scale, from zero to a maximum of ten. The scanning light beam travels through the lens and exposes the photographic material on the easel. The center of the easel is perforated and a second phototube is located below the circular opening in the base of the enlarger. Some of the exposing light travels through the sensitized material and is picked up by the second phototube located below the easel. This phototube is connected to a photomultiplier which will terminate the exposure when a predetermined volume of exposing light has reached the sensitized material on the easel.

Our Modifications of the LogEtronic Enlarger

The Model D-5 enlarger for 4 x 5 inch negatives used for this project was modified to accommodate up to 11 x 14 inch X-ray films. As stated above the areas of interest in the material used never exceeded 4 x 4 inches. Since it was desired to make actual (1 : 1) size reproductions the enlarger was set at this factor. The enlarger is originally equipped with a fluorescent tube focusing light. This light was replaced with a No. 212 enlarger bulb in a light housing with a 6½ inch condenser. This assembly was mounted on a bracket allowing it to be swung into position over the negative carrier (Fig. 2). This light is bright enough to permit critical focusing with very dense X-ray films. With the focusing accomplished and the area to be reproduced properly centered over the easel, the light is turned off and the focusing light assembly is moved to the left side of the enlarger and the CRT is swung into position above the negative carrier. The second modification consisted of a negative carrier large enough to hold an 11 x 14 inch X-ray film firmly in position while the 4 x 4 inch square area on the film is reproduced (Fig. 3). The negative carrier consisted of two sheets of good quality window glass, ⅛ inch thick, 12 x 14 inches in size, hinged on one side with tape. A sheet of blue masking material (transparent plastic) 11 x 13 inches was placed between the glasses. A 5 x 5 inch window was cut in this mask, situated in such a way that it will be centered below the CRT, when the negative carrier is placed in the enlarger. The third modification of the enlarger consisted of the installation of two pointers and two scales which are very helpful in locating commonly used magnification settings (Fig. 2). The black pointer is fastened to the lensboard and points to the desired bellows extension. The gray pointer is fastened to the movable section of the carriage which raises and lowers the camera. It points to the scale on the enlarger housing. When 1 x, 2 x, 3 x, etc. magnifications are desired it is merely necessary to line up the proper marks on the two scales and the image will be in focus. Critical focusing is done with the fine adjustment and the help of the focusing light. In order to precisely locate the 4-inch square on the X-ray film to be reproduced, the film was laid on a view box. A 5-inch square of clear Plexiglass was centered over the desired area and a pencil line was drawn around the edges. This assured getting the 4-inch square without having pencil marks in the image and preserves the original film so it can be returned to the files. In most cases it was possible to center this area in the window of the negative car-

rier without having to cut off any of the X-ray film.

Making the Intermediate

In selecting a film for making the intermediate the following characteristics are desirable: (1) the film should have a long scale and fine grain, (2) it should be slow enough to permit exposures in or near the center of the exposure index scale, and (3) film contrast should be variable, obtained by the choice of the developer and the selection of the developing time. In addition the film should be suitable for handling with Series 1 safelight, the illumination most

Figure 2

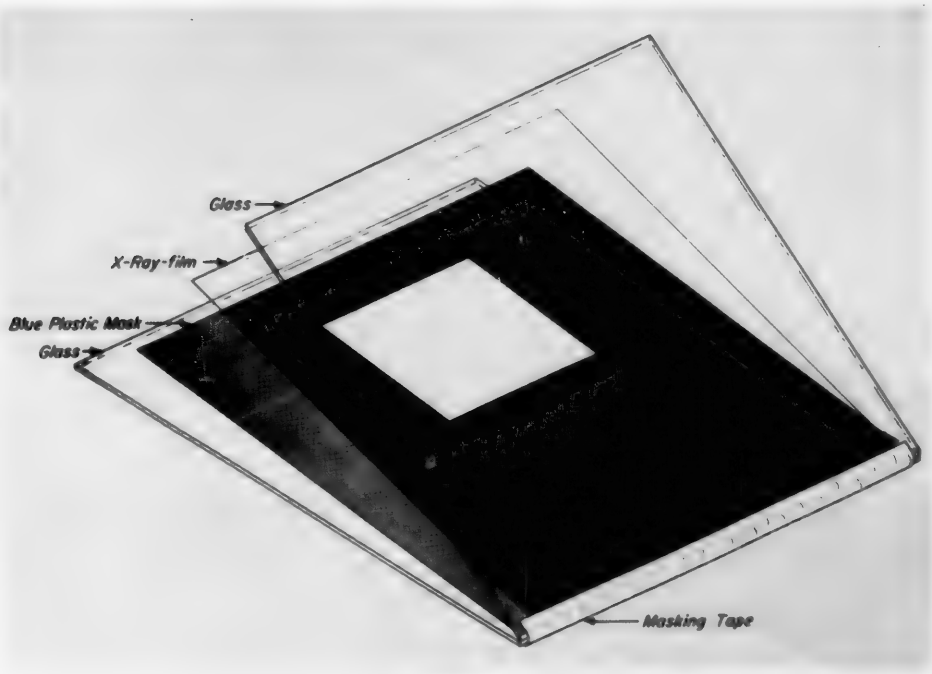

Figure 3

useful when working with the Model D-5 enlarger. (It has been observed, when working with enlarging paper and using Series OA safelights, that the darkroom illumination is too "bright". The photomultiplier receives "false" information, it picks up stray light from the OA safelights with resulting underexposures). The films that meet most of these requirements are Eastman Kodak Commercial, Eastman Kodak Gravure Copy, Ansco Commercial, Gevaert Correctone, and Dupont" Cronar" Commercial. For this series of reproductions Dupont "Cronar" Commercial was used. The exposure index for most of the X-ray films was from 35 to 55 units. A dodging factor of 5 resulted in good intermediates in approximately 75 per cent of the films. The full range of dodging — 10 — was used on the remaining 25 per cent of the reproductions. The intermediates were developed 4 minutes at 68°F. in freshly prepared D-11. A 135mm Schneider Componar f/4.5 lens was used on the enlarger at an aperture of f/5.6. Referring to the marks on the focusing scale, the enlarger was set precisely at 1 : 1. The prints of the intermediates were made with the enlarger at the same setting, resulting in exact duplicates of the original X-ray films. Medalist paper grades 2, 3, and 4 were used at an exposure index of 350 to 600 units. The dodging factor ranged from 2 to 5 in most cases. The full range of dodging 10 was seldom used in making the prints. For making lantern slides the enlarger setting was changed to reduce the size of the image. A cardboard holder with a 2½ x 3½ inch square opening was placed over the center per-

foration of the easel. The exposure factors for the lantern slides ranged from 30 to 50 units with a lens aperture of f/8. There was no evidence that the red coating on the back of the lantern slides interfered with the exposure control of the enlarger. The dodging factors used were the same as those used for making the prints.

Our Experience with the Modified LogEtronic Enlarger

We have made four series of approximately 500 reproductions of neuroradiological radiograms with the modified LogEtronic enlarger. Every type of neuroradiological radiogram has been reproduced: plain skull and spine X-rays, skull and spine laminagrams, pneumoencephalograms, carotid and vertebral arteriograms, and gas and Pantopaque myelograms. In the series of 500 reproductions the number of "repeats" was only 5 per cent. The time required to carry out the work was considerably reduced. In most cases the full range of dodging was not necessary to obtain the best reproduction. The quality of the reproductions has been generally good and by and large comparable to the

Figure 4A

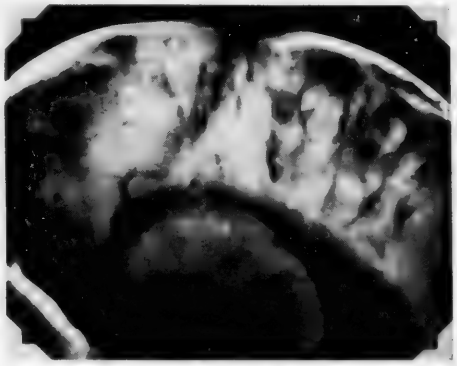

Figure 4B

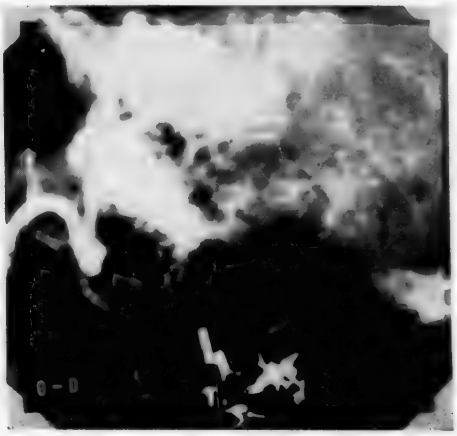

Figure 5A

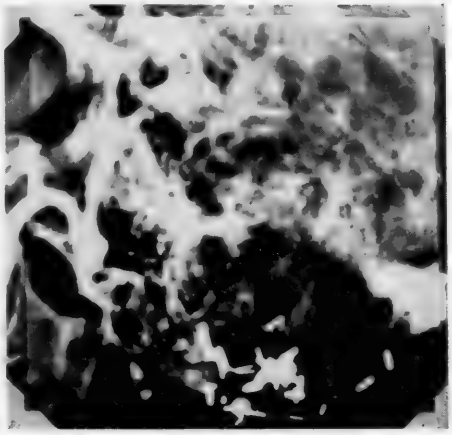

Figure 5B

quality of reproductions which may be obtained by the LogEtronic contact printer.

Figure 4 shows a pneumoencephalogram in which the Logegram obtained with the LogEtronic enlarger (B) puts clearly in evidence the cerebral sulci which are lost in the standard contact print (A). Figure 5 shows a cerebellar vascular tumor in the Logegram (B): the same tumoral nodule is not seen in the standard contact print (A).

Summary

The LogEtronic enlarger has been used to reproduce sections not larger than 4 x 4 inches of a great number of neuroradiological X-ray films with favorable results. To achieve this, certain modifications of the LogEtronic enlarger have been introduced.

Acknowledgments

We are indebted to Mr. Wesley Pearson, Jr. for his technical assistance. Figure 1, Schematic of LogEtronic Enlarger, is reprinted by permission of LogEtronics Incorporated.

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Dr. Oscar W. Richards, FBPA, *FRMS*

The outstanding contributions of Dr. Oscar W. Richards, FBPA, to the field of microscopy have once again been formally recognized. On June 14, 1960, during the official Banquet of the 1960 McCrone Microscopy Symposium, in Chicago's Del Prado Hotel, Dr. Richards was presented a Certificate of Fellowship in the Royal Microscopical Society. The presentation was made personally by Dr. John Bunyan, President of the Royal Microscopical Society.

Dr. Richards has been associated with the American Optical Company for many years. He is well known to most BPA members as an active supporter of the Association. Dr. Richards is a past President of the BPA and also served as Editor of the Journal.

Washington, D.C. — If the modern camera fan had to use the photographic equipment of a few generations ago, picture-taking would definitely not be the universal hobby it is today. The photographic exhibits at the Smithsonian Institution in Washington trace the amazing improvement and simplification in over a century, of still and motion-picture cameras, projectors, films, color processes, and lighting equipment.

These Smithsonian exhibits might justifiably be called the "national gallery of photography." They are believed to be the most comprehensive in existence. Not only is technical progress illustrated by the original still and motion-picture cameras and related equipment, but the story of evolving photographic processes is briefly told on a series of labels. Many of the historic "firsts" in photography could not be found in any other museum in the world.

A camera made by John W. Draper in 1839, one of the first to appear in America, would not be the type to take along on a picnic today. It consists of a wooden box nearly 2 feet long, with a 3-inch brass tube projecting from the front end. Passing through the daguerreotype era, when only one copy of a reversed image on metal could be produced by each camera exposure, we come to the first truly practical photographic process for making real "negatives" — that developed by Talbot in England in 1839.

Examples of tintypes, popular for many years after 1855, precede those of the wet-plate era, which persisted up to around 1880, when the then slower dry-plate process came into its own. From that time on, the cameras begin to look more modern and lead gradually up to today's automatic light-adjusting hand cameras with which anyone can snap perfect pictures under almost any conditions.

A similar series of actual specimens illustrates a comparable development of movie cameras and projectors from the very beginning of the art. A valuable "original" is a part of the Vitaphone equipment used by Warner Brothers to present "The Jazz Singer," starring Al Jolson, the first sound motion picture to contain dialogue. Its premiere showing occurred on October 8, 1927.

Another "first" in the exhibits is the machine on which the first radio photographs were received from across the Atlantic in 1929.

Ordinary picture-taking is, of course, only one phase of the photographic art. The Smithsonian gallery of photography also illustrates applications in the science of medicine, in other sciences, and in industry. Also shown are the ways in which our armed forces depend upon films.

Photography has also come to occupy a definite place in the world of art. Besides having on permanent exhibit distinguished examples of photographic art, the Smithsonian announces each year six or eight special showings of the work of outstanding photographers and of special applications of photographic processes in various fields of science.

Upon completion of the Smithsonian's new Museum of History and Technology, now under construction on the Mall in Washington, the present photographic exhibits will be greatly expanded by the addition of important historical and technical material now being acquired in this country and from abroad. To demonstrate the workings of cameras, projectors, and other photographic implements, the new collections will stress equipment that can be operated by Museum visitors.

The motion-picture exhibits will be enriched by a scale model of "Black Maria," Thomas Edison's first motion-picture studio. Another exact reproduction will be a studio of the old wet-plate days, when victims to be photographed had their heads rigidly held in place by an iron clamp so that they could not spoil the plate by moving during the long exposures of that day.

Journal of the Biological Photographic Association Vol. 28, No. 3, August, 1960

A Method of Reproducing 35mm. Color Transparencies

JOSEPH THOMAS LAPPAN

Director of Audio-Visual Department, Mercy Hospital,
Pittsburgh 19, Pennsylvania

THIS method has been thoroughly worked out through trial and error, proving to be a reliable method of reproducing color transparencies and black and white duplicates. In this article we omitted the 35mm. black and white, as we are primarily interested in copying color slides. The principal reason for making copies is that the original can be preserved permanently in the files. The reproductions of 3x4 and 2x2 slides may then be used by the residents, interns, nurses and other personnel. The virtue of the method is that it can be done in the studio — without a darkroom, and involves a very simple procedure. The guesswork is also abolished by the use of a chart which shows the correct method of procedure and proper exposure.

The set-up consists of a Model #2 Copy Mat with an optical bench system and the Exakta V X 11a with the waist level finder. The Exakta is mounted on the focusing slide and bellows with two different scales, one is for the 50mm. lens and the other for the 105mm. lens. They are identified by one scale being black and the opposite being red. We have found that the Extenar 50mm. F 2.8 is the best lens to use for copying because it can be used at 1 inch to infinity without extension tubes. The waist level finder with magnifying glass is used so that the transparency can be framed easily. The Vielzweck bellows focusing device is infinitely better than the ordinary 35mm. camera because one can control and magnify the original to whatever enlargement or position desired. Where the object distance in relation to the bellows attachment remains unchangeable adjustment of the image distance, and subsequent absolutely sharp focusing, are possible by backward or forward movement of the camera holder on the gliding rail. This is the extraordinary advantage of the bellows attachment. As can be seen from photograph, Figure 1, some of the parts have been borrowed from various sources. A very substantial table can be seen in Figure 1. This is a Neumade Model T 159R, basically used for motion picture film splicing and editing. The height of the table makes it suitable for the focusing, alignment, etc., of the film from a comfortable secretarial chair. A Shurite line tester should be used to indicate the correct voltage. Being situated in a large institution one cannot rely on constant voltage of 110 volts. A Powerstat type 116 with the markings and capacity of 140 volts should be placed in a convenient position on the table so that it can be controlled and adjusted to the correct voltage. We have found that by using three 40 watt, 120 volt tubular frosted glass bulbs, illumination requirements

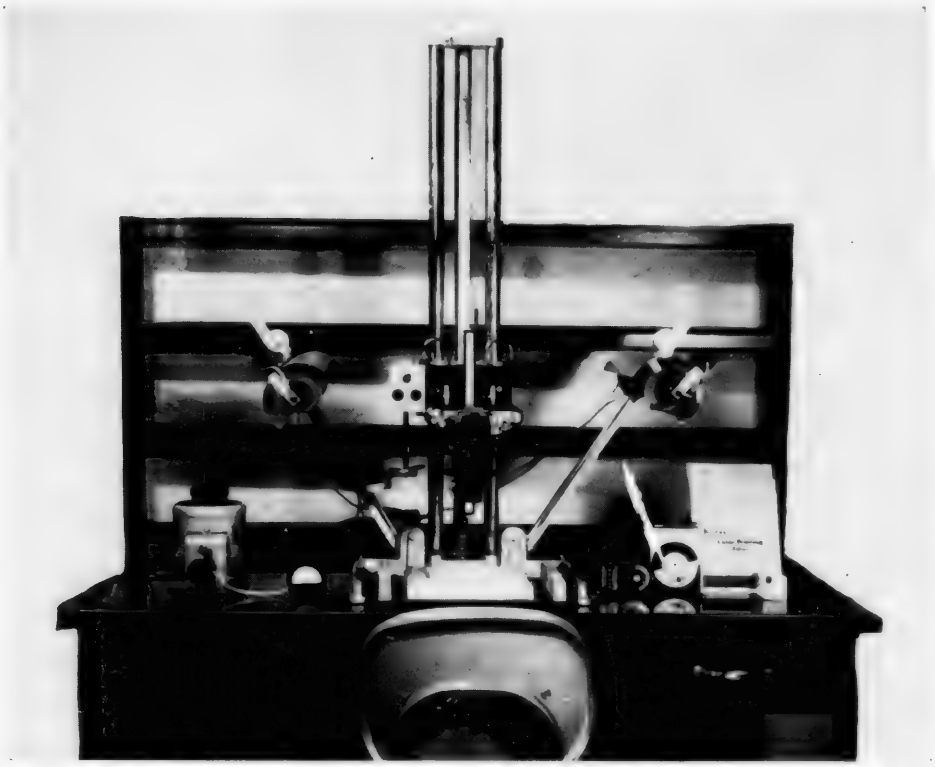


Figure 1. This illustrates the complete apparatus with the Copy Mat, chair, Exakta camera, Powerstat, Shurite line tester, filters, film, and Neumade table.

are adequate. The bulbs are easily replaced and the cost is negligible. The heat produced from these bulbs in the 6″ x 8″ submerged viewbox causes no damage to the transparency or acetate filters. Therefore, this equipment could be considered basic and necessary. Figure 2.

During the experimentation we tried a multiple combination of cyan, yellow, magenta, blue and red filters, and by the process of elimination found a suitable couple. The types that were used are C P Kodak Color Printing Filters, 5″ square and made of acetate. These filters are not satisfactory for optical use, such as for placement over the camera lens. The two filters chosen are .05M and .05C plus the bluish tinted opal ground glass formerly used in x-ray viewing boxes. A primary colored transparency for example, the heart, causes little trouble in true reproduction. The difficult problems were to duplicate the pastel flesh tones in clinical slides of patients. By using the above mentioned filters and glass we were satisfied with the results obtained. It has been proved through the years that it is difficult to secure good duplicates consistently for a reasonable cost. We feel that this new technique has simplified the problem.

The voltage was another difficulty which had to be overcome. We began

with 110 volts and exposed slides at every volt until we reached 132 volts and the highest voltage proved to be the most satisfactory for brightness and kelvin degrees. The Powerstat is used to increase the intensity of the three 40 watt frosted tubular bulbs to equal the illumination of a No. 2 photoflood. The longevity of these small bulbs is over 100 hours. One important point; there will be no drop in voltage by using this transformer.

The next question that will be asked is, what type of film do we use? Since we are not seeking speed for a permanently fixed object we selected Kodachrome, Type A, Professional 35mm. film. It is advisable for the user to purchase a 100 foot roll. There are two reasons, the economy of buying bulk film and the control of the reproduction through experimentation with +5 or −5 tolerance, which one expects in the different series of Kodachrome. It is a definite advantage to use a transparent Eastman Step Wedge and photograph the wedge on the initial film. When it is returned from processing it will be possible to compare the film with the original wedge. The remaining film from the original 100 feet can now be adjusted accordingly.

The important step as it is in all photography, is to use the correct exposure. If one wished to reduce a 3 x 4 Ektachrome, there are a few necessary precautions. The bellows must be shortened about one inch, thereby changing the

Figure 2. This is a close-up of equipment that is used for this method. 1—Powerstat Type 116 2—Shurite line tester 3—Weston meter 4—Extenar 50 mm. f 2.8 lens 5—40 watt frosted bulb 6—Exakta VXIIa body 7—Vielzweck bellows focusing device 8—Blue tinted opal glass with frame.

exposure as related to copying a 35mm. one to one. We use a discarded spot light cone with a magnifier which is 3 inches high and 3½ inches in diameter. By placing the meter on top of this cone, which is in a reverse position, the meter will cover about ⅞ of the large slide. The reading must be made with the original slide placed on the bluish opal glass and filters covered with non color 1/16" picture glass made by Pittsburgh Plate Glass Company and illuminated from below. It is a rare occasion for the indicator to go beyond 25 on the Weston 11 meter. With a variety of colors in a slide it is difficult to judge the correct exposure with the naked eye. The readings and aperture used when copying a 3¼ x 4 slide are: Weston 3.2 = F 8; Weston 6.5 = F 11; Weston 13 = F 14. The exposure time always remains at one second. When copying one to one from a 35mm. slide, the meter is placed directly on the transparency. Since the bellows is further extended the exposure changes to: Weston 3.2 = F 4.5; Weston 6.5 = F 5.6; Weston 13 = F 6.3. The final change to note is that the original rating for Type A Kodachrome of 16, exposure index but the rating must be set at 3 E. I.

Summary

We have found this apparatus to be simple, reasonable in cost, and one that does not occupy a large space in the department. It may be operated with ease. The photographer also can be comfortably seated while operating the apparatus. For those who already have the Exakta, the optical bench system, and the Copy mat vertical stand, the remaining apparatus is reasonable in cost. The correct selection of filters is a must and they should be of the Color Printing Series. By using bulk film, cost can be reduced plus being able to judge the performance of the specific 100 feet of color film, after the initial trial. This apparatus will not tie down the camera as it can be easily removed and used for other purposes. A Powerstat or equivalent and line tester are used to increase voltage and regulate brightness of the light source. We selected the Weston 11 meter because it has proved satisfactory in other types of medical photography. In copying the 2 x 2 there will be no difficulty in reproducing it one to one, by previously mentioned bellows arrangement. Other types of cameras would no doubt be equally satisfactory.

With this reproducing unit in one's own department there is the satisfaction of being able to accomplish results with good color, good reproduction and most important, favorable comments.

This article is dedicated to Dr. A. J. Bruecken, Pathologist and a pioneer in medical color photography in Pittsburgh.

Journal of the Biological Photographic Association Vol. 28, No. 3, August, 1960

Adaptation of the "Focuspot"* Rangefinder for Closeup Flash Photography**

JOHN N. SCHUTZ
Naval Biological Laboratory, School of Public Health,
University of California, Berkeley

A "FOCUSPOT" rangefinder has been modified for use in closeup flash photography of small objects by repositioning the mirrors and by adding an adjustment screw on the mirror control. By attaching the modified rangefinder to the flashgun, the flash lamp can be placed quickly and accurately at predetermined distances, from 6-36 inches, from the subject. This system eliminates the need for tape measures or other framing devices and protects subjects which must be kept isolated or bacteriological subjects which must be kept uncontaminated.

Reposition mirrors at points A and B.
Install adjusting screw at point C.

*Trade name — (Other similar type rangefinders can also be used)

**This work was sponsored by the Office of Naval Research, U. S. Navy, under a contract between the Office of Naval Research and the Regents of the University of California.

Opinions expressed in this report are not to be construed as reflecting the view of the Navy Department or of the naval service at large (Article 252, U. S. Navy Regulations, 1948). Reproduction in whole or in part is permitted for any purpose of the United States Government.

Journal of the Biological Photographic Association Vol. 28, No. 3, August, 1960

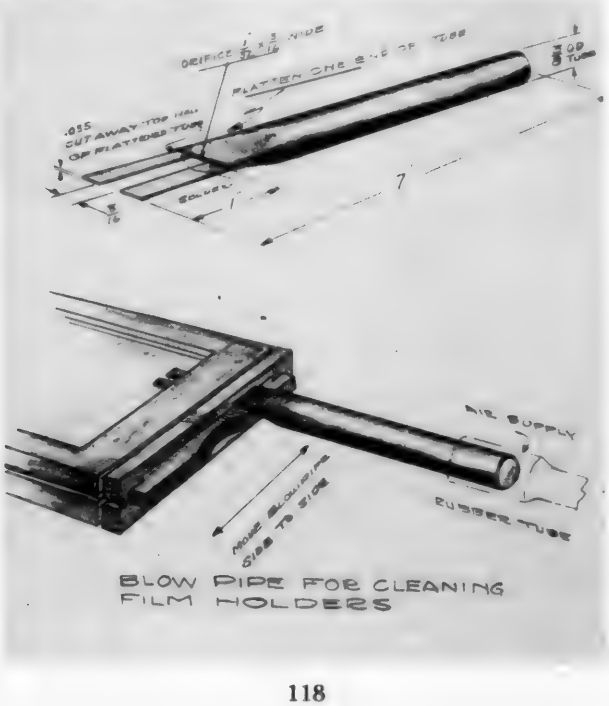
Blow Pipe for Cleaning Light Traps on Film Holders

JOHN N. SCHUTZ

Naval Biological Laboratory, School of Public Health,
University of California, Berkeley

THE maintenance of dust-free film holders has always been a problem in photography. However, we have been able to overcome much of this dust problem through the use of a blow pipe which opens the light traps and dislodges the dust particles.

The blow pipe is made of 3/8" thin wall copper tubing. One end of the tube is hammered flat. One side of the flattened end is then cut away. A slot is cut back on the remaining area to the point of the opening in the tube. The edges are filed smooth so that the air will only blow through the thin opening (1/32"). The completed tube is attached to a filtered air supply and then pushed into the light trap of the film holder. The two fingers of the pipe open the felt trap and the effluent air dislodges the adherent dust which is blown away.



Journal of the Biological Photographic Association Vol. 28, No. 3, August, 1960

Cineangiography With Simple Therapy X-ray Equipment*

KENNETH A. ARENDT, Ph.D.** and C. GORDON HEWES, Ph.D.***

THE researcher who operates on a modest equipment budget must frequently make available apparatus perform functions for which it was not originally intended.

In the course of experimentation related to the delineation of the blood vasculature in opaque soft tissues and bone, the authors decided that motion pictures made while the contrast medium was being injected, could more adequately indicate the course of the blood as it traverses the tissues, than could still contact radiograms of an already perfused tissue segment.

Although the hospital associated with our pre-clinical campus has some excellent x-ray equipment, including liquid cooled, rotating anode sources and an image amplifier, the matter of integrating research use of the apparatus with heavy clinical demands appeared prohibitively complex. Furthermore, it was feared that the introduction of experimental animals into a clinical plant might precipitate repercussions originating with the esthetic sensibilities of the human clientele.

Equipment and Procedures:

In the Department of Anatomy there was available, for our uninterrupted use, a somewhat obsolete but perfectly functioning therapy x-ray unit employing a Westinghouse air insulated WRDF tube. This tube provides a small (2.1 mm) focal spot for fluoroscopy or radiography where maximum definition is important. The primary difficulty encountered was that of inadequate cooling. However, when exposure sequences of relatively short duration (15 to 20 seconds) were properly spaced it was possible to remain within the hot tube safety limits defined by the manufacturer.

The photographic setup is shown in figures 1 and 2. A simple stage was constructed from a piece of ½" plywood with a centered 6" diameter hole, and a few lengths of 1" x 2" pine. A DuPont "Patterson" type CB-2 fluoroscopic screen (8" x 10"), protected by an ordinary plastic poultry bag, is placed over the hole and a ⅛" thick lucite platform is supported about ⅜" above the screen by means of strips of wood. That portion of the dog, rabbit, or hamster which is to be perfused (usually an extremity) is centered upon this platform.

It may be of interest to note here that in the preliminary phases of this work the face of a used 7" oscilloscope

* Research aided by grant A-1762 from the National Advisory Council on Arthritis and Metabolic Diseases, of the National Institutes of Health.

** Department of Physiology, College of Medical Evangelists, Loma Linda, California.

*** Department of Anatomy, College of Medical Evangelists, Loma Linda, California.

tube (coated with P-7 phosphor) served admirably as a fluoroscopic screen.

The camera, a spring driven Bolex H-16 Reflex with a standard 25mm f/1.5 Pizar lens is mounted on a rigid pipe base, although a sturdy tripod would serve equally well. With a 3mm thick closeup ring, a lens-to-screen distance of 11″ provides a field of coverage approximately 2¾″ x 3¾″. A shield of leaded rubber (⅛″ x 5″ x 12″) with a hole to allow protrusion of the lens, is draped over the camera box. This protects the film on supply and take-up spools from radiation fogging. The camera is operated by means of a long cable release from a position behind a protective screen.

After considerable consultation and experimentation it was found that the film best suited for our purposes is Kodak Cineflure. For maximum contrast the film is processed in Kodak Developer D-8. Very satisfactory exposures have been obtained at 24 frames per second with a lens diaphragm setting of f/2.8, a tube target-to-platform distance of 9″, and an output of 50 Ma at 80 Kv.

Filming at higher speeds, although feasible from the standpoint of adequacy of exposure, would require a shutter drive synchronized with the x-ray pulses. This is a problem with which the authors were neither prepared nor inclined to tussle. Furthermore, a 20-second run at standard sound speed proved to be sufficient to demonstrate the progress of a column of radiopaque material (Thorotrast) from the site of infusion at the femoral

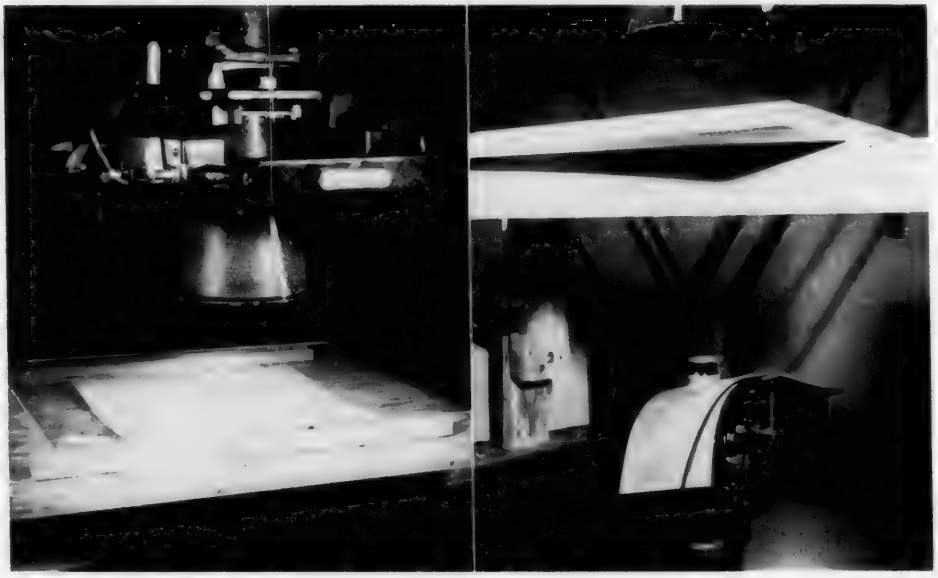


Figure 1. Arrangement of fluoroscopic screen, plastic platform, and x-ray source above plywood stage.

Figure 2. Substage mounting of 16 mm motion picture camera. Note protective covering of leaded rubber.

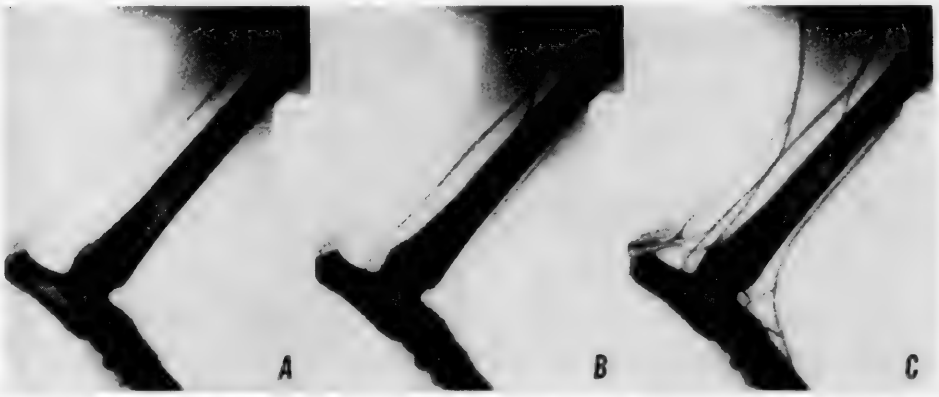


Figure 3. Progress of radiopaque solution (Thorotrast) through vasculature of dog hind limb: (A) Initial appearance in arterial segment; (B) Passing down limb; (C) Nearly complete perfusion of limb. (Enlarged from 16 mm frames).

artery, for example, down through the terminal vasculature of the foot (Figure 3:A-C).

Immersion of tissues in water, according to the method described by Vose[1], provided some interesting results although the exposure problem was somewhat complicated.

In spite of the fact that the graininess in a fluoroscopic screen is somewhat augmented by high contrast development and considerable enlargement of the 16mm frame, the feature of motion makes possible an entirely intelligible projected image.

Summary:

X-ray cinematography of blood vessels in opaque tissues can be accomplished with simple 16 mm photographic equipment and an ordinary therapy x-ray source.

Acknowledgements:

The authors appreciate the help and council of Mr. E. N. Hamilton, Director, Audio-Visual Service of the College of Medical Evangelists, and Mr. Maurice LeCover, Chief, Department of Photography, Cedars of Lebanon Hospital, Los Angeles.

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1 Vose, George P.: A water immersion technique for producing high detail radiographs of laboratory animals. Journ. Biol. Photogr. Assoc. *26* (2): 81-86 (1958).

MEDICAL AND BIOLOGICAL ILLUSTRATION

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WANTED — CIVIL WAR PHOTOGRAPHS

In observance of the centennial of the Civil War, photographers are being urged to search through their photographic files and among family possessions in attics, trunks and storerooms to uncover photographs of life in the early 1860's that would contribute to the history of photography and to the general history of the period.

The search is being conducted by the Professional Photographers of America in cooperation with the National Civil War Centennial Commission.

Information on photographs or wartime memorabilia, diaries, letters, newspapers or maps, should be sent to the National Photographer, official magazine of the PP of A, 152 W. Wisconsin Ave., Milwaukee 3, Wis.

According to officials of the Library of Congress and the National Archives, the need is especially great for Confederate photographs generally, photographs of battle scenes and of battle sites, pictures of ships, river craft, locomotives and railroad cars used by either side, and scenes of training camps, military prisons, supply depots and industrial plants, especially plants engaged in war production.

Also needed with the pictures is information on the photographer, the date, the place, etc. No material will be returned unless requested but will be preserved by the PP of A.

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DOROTHY PINKHAM
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Scope of Conference

A fifty-one paper program, highlighting the broadening advancements in medical electronics, has been scheduled for the 13th Annual Conference on Electrical Techniques in Medicine and Biology which will be held at the Sheraton-Park Hotel, Washington, D. C., on October 31, November 1-2, 1960.

In eight sessions, over 90 international authorities will discuss the latest developments in analytical methods and instrumentation, electroanalytical methods, digital computers, telemetry of physiological data — long and short range, physiological measurements, analogs and systems analysis, and instrumentation. In addition, four informal discussion sessions will be held to probe such vital subjects as polarography, nuclear and electron magnetic resonance, computer methods, and remote recording and stimulating for physiological experiments.

Session chairmen include R. L. Bowman, National Institutes of Health; R. H. Shepard, Johns Hopkins University; G. N. Webb, Johns Hopkins University; J. E. Jacobs, Northwestern University; H. B. Schwan, University of Pennsylvania; P. L. Frommer, National Institutes of Health and W. Greatbatch, University of Buffalo.

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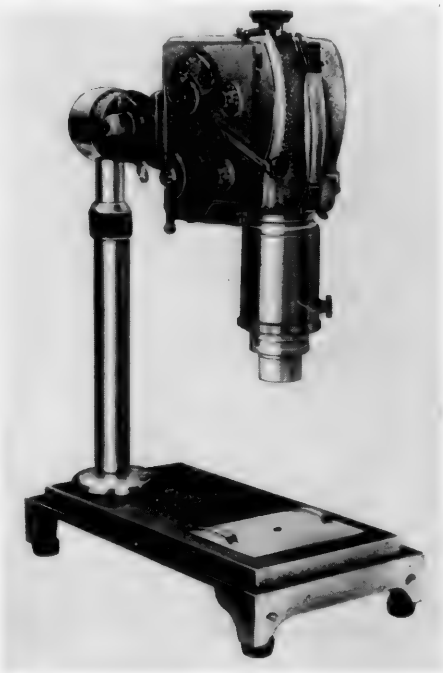


focusing and depth-of-field control, at any distance. The price is $29.95. Distr.: Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y.

LAB PROBLEM SOLVED BY NEW DEVICE

New York, April 15: S.O.S. Cinema Supply Corporation has announced its new LECTRONOTCH delay timer. The device, a variable time delay unit, is designed to solve the laboratory problem of spacing differences in motion picture printing cue systems.

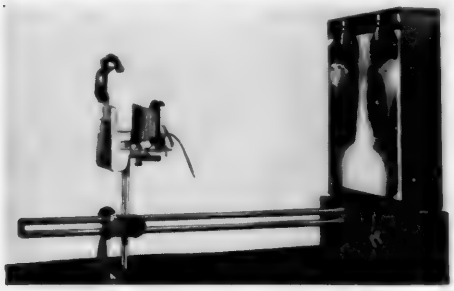
Joseph A. Tanney, President of S.O.S. explained: "Quite often laboratories are faced with the problem of running negatives notched for a particular machine on another type printer with a longer scene-to-notch spacing. In the past, they have met the problem by employing one of several methods, patching and renotching, reprinting with a single timing light, or maintaining an old non-standard printer especially for the job. All of these methods produce inferior results and are costlier. Our new LECTRONOTCH unit simply delays the impulse to the light-change mechanism until the correct frame is in position."

Tanney went on to say that prototypes of the unit have been in constant use for quite some time in laboratories of the National Film Board of Canada. They have proved to be very successful and have paid for themselves many times over.

The LECTRONOTCH is priced at $195. Literature may be obtained by writing to S.O.S. Cinema Supply Corp., 602 W. 52nd St., New York 19, N.Y.

OFFICE X-RAY COPIER

The purpose of the Remicro Minute Master office x-ray copier is to provide an easy-to-use copy stand which will give you fast, efficient service on prints or lantern slides using the Polaroid Land Camera at a minimum cost. This is simplicity itself (your office girl can operate it). Place an x-ray on the illuminator, press the camera release button,

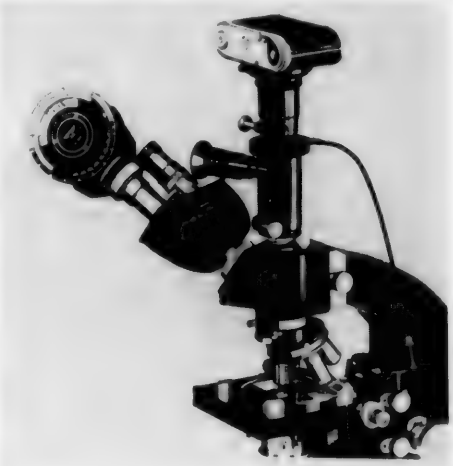


develop the print or slide in the camera and the job is done. 35mm and 4 x 5 cameras can also be used. Only 45½" in length it takes a minimum amount of costly office or storage space. It is extremely sturdy and yet precisely constructed and attractively finished. Complete instructions are provided to assure perfect results from the start.

If you would like further information or the name of your local distributor, please contact us. List price is $75.95 f.o.b. Milwaukee. Remicro Scentific Instrument Co., 1000 N. 3rd St., Milwaukee 3, Wis.

EXPOSUREMETER FOR PHOTOMICROGRAPHY

A new ultra-sensitive exposure meter for photomicrography known as "REMIPHOT" was developed and is now available. The "REMIPHOT" can be used for exposure measurement with any camera-microscope combination. This universal application becomes possible through the use of an instrument factor the so-called "INDEX", which depends on the type of microscope and camera used. On the "REMIPHOT" the exposure time can be read on the scale of the instrument. The



"REMIPHOT" measures an "integrated" light value that is a mean value of the light intensity in the plane of the film. As light-sensitive element it employs a semi-conductor photocell. The minimum light intensity which can be measured with the "REMIPHOT" is approximately 0.1 microlumen; the maximum value is several million times greater. The exposure time scale is graduated from 1/500th to 4 hours.

For complete particulars, please contact William J. Hacker & Co., Inc., P.O. Box 646, West Caldwell, New Jersey.

AUXILIARY TARGET FINDER NOW AVAILABLE

In sports, wildlife, industrial, military and missile motion picture photography, long focal length lenses are used to get large image sizes at long range. Since the field of view of such lenses is extremely small, it is often difficult to "find" small, fast moving objects in the camera viewfinder.

The Arriflex 16, because of its mirror reflex shutter, has always been a "natural" for long range tracking. To further facilitate this work, the Auxiliary Target Finder for Arriflex cameras is now available and has just been announced by the Arriflex Corporation of America, 257 Park Avenue South, New York 10, N.Y.

The photographer may now bring his long focal length lenses on target quickly and easily. The Albada optics of the finder are mounted and aligned as shown in the accompanying photograph. The design of the

instrument is such that the cameraman sees a bright, clear reticle projected in space out over a wide field. The center dot of the reticle is easily super-imposed on the target. When once the instrument has been aligned, centering the target in the reticle of the target finder, automatically centers the object in the frame of the camera.

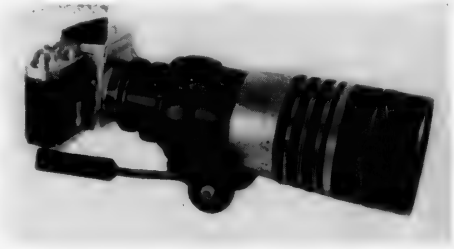
The finder will be available in three models. The accompanying photograph shows the finder mounted on a late model Arriflex 16. Additional models of the finder will be available for the Arriflex 35 and older models of the Arriflex 16. Installation is accomplished in a very few minutes without special tools. Adjustment for interpupillary distance is readily accomplished. The basic alignment, and adjustment is made once. Thereafter, the Target Finder may be readily removed and replaced without readjustment.

The Auxiliary Target Finder sells for $80.00, and is available from all Arriflex dealers. Additional literature is available from Arriflex dealers, and from the Arriflex Corporation of America, 257 Park Avenue South, New York 10, N.Y.

NEW KILFITT ADAPTER FOR NIKON REFLEX CAMERA

Owners of Nikon Reflex cameras can now take advantage of the full range of Kilfitt long focus and tele Kilar lenses with focal lengths from 150 to 600mm (6 to 24 inches), by using the new Kilfitt "Kinik" lens adapter just introduced to the U.S. market by Kling Photo Corporation, New York, N.Y., sole distributor of West Germany's Kilfitt Optical Precision Products.

Equipped with its own tripod socket, the Kinik adapter fits the bayonet mount of the Nikon Reflex camera, and has a front thread



to accept all Basic Kilar lenses from 150mm to 600mm focal length. Like other Kilfitt De-Luxe adapters, the Kinik permits turning the camera to horizontal or vertical even while mounted on a tripod.

Another important feature is the exclusive Kilfitt built-in filter holder for gelatine filters which eliminates the need for costly, large diameter glass filters, and permits the use of the complete color scale of gelatine filters.

Lenses which may now be used with the Nikon Reflex camera are: 150mm (6") f/3.5 Tele-Kilar, 300mm (12") f/5.6 Tele-Kilar, the unique 300mm (12") f/4 Pan-Tele-Kilar with duo-focusing range from Infinity to 5½ ft, as well as the long-focus 400mm (16") f/5.6 Fern-Kilar, 400mm (16") f/4 Sport-Fern-Kilar, and 600mm (24") f/5.6 Sport-Fern-Kilar. The Pan-Tele-Kilar and Sport-Fern-Kilar lenses are equipped with fast focusing lever for "straight" focusing.

The new Kilfitt Kinik adapter, priced at $24.50, is sold through better camera dealers.

RICHARD FLAT BOTTOM PLASTIC PHOTO TRAYS

Richard Manufacturing Company announces the availability of FLAT BOTTOM PHOTO TRAYS. *The same high quality, sturdy styron plastic as used in the companion line, Richard Raised Rib Trays, is retained in this new product. This laminated material gives a non-porous surface on the inside of the trays, providing maximum acid and stain resistance. Easily recognizable by the smooth glossy finish, this material is guaranteed to withstand all usual photographic chemicals. The Flat Bottom trays are made in 4 popular amateur-professional sizes: 8x10", 11x14", 16x20" and 20x24". All trays are larger than print sizes to allow for finger room. The best government and industrial specifications were included in the design, incorporating rounded corners for easy cleaning, tapered sides for stacking, pouring lip and flat bottom to insure maximum economy and efficiency for film and print processing. Prices range from $2.25 to $14.95. Available from your dealer or write for descriptive brochure. Richard Manufacturing Company, P.O. Box 2041, Van Nuys, California.*

NEW OLYMPUS AUTO EYE, THE ONLY FULLY AUTOMATIC ELECTRIC EYE CAMERA, THAT WORKS 3 WAYS

New York City—Scopus, Inc., importers of the world-famed Olympus Cameras, announces the introduction of the new OLYMPUS AUTO EYE 35mm camera. This fully automatic electric eye camera represents the culmination of years of research and development in photographic automation that appeals to and serves both the amateur and professional alike. The Olympus Auto Eye, therefore, was specifically developed with 3 functions in mind.

1. Completely Automatic, *with automatic self adjusting diaphragm for the amateur, or for fast professional shooting.*
2. Automatic Flash Setting, *simply set bulb guide number next to distance. Exposure is set automatically.*
3. Complete Manual Control *of diaphragm, shutter speeds, depth-of-field, focusing (all controls) for the serious amateur and professional.*

1. Completely Automatic. *The Auto Eye is loaded with film, the ASA lever is set to film in use, and the shutter speed is set for hand held pictures (1/60 or higher). The photographer sights through the finder (and either*

uses the rangefinder or simply sets focusing on "close", "group" or "scene"), presses the shutter release button and gets perfectly exposed pictures. For subsequent pictures he simply sights and shoots—the diaphragm automatically closes or opens, depending upon light conditions.

2. Flash-Matic System. *Once the distance is set next to the flash-bulb guide number the correct exposure is automatically made and the lens opening also appears in the finder. No computations are required.*

3. Complete Manual Control. *Simply move setting away from "A" (automatic). The shutter speed and aperture can now be set manually for complete control of shutter speed, depth-of-field, etc.*

Compu-Matic Shutter Release System. *While looking through the viewfinder with the Shutter Release Button depressed half-way, the f/stop number appears, this indicates that there is enough light to properly expose and the photographer can continue depressing the Button until it clicks. The lens opening has automatically adjusted to the proper f/stop and is shown in the finder. If a curved red arrow appears, there is not enough light. By turning the Shutter Speed Dial in the direction of the arrow, the arrow disappears and the proper f/stop automatically appears. For Depth-of-Field control the Dial is turned until the desired f/stop appears in the finder.*

Unique Quick-Look Low-Light Indicator. *A yellow warning needle appears in a window at the back of the camera when the light is below the range of the built-in-exposure meter.*

Widest Range of ASA Speeds. *The Auto Eye is the only camera in its class covering the wide range of ASA speeds from 10 to 800, with shutter speeds from 1 to 1/500th second and bulb. Light Value at ASA 100 is from 7 to 17.*

Accessory Booster for Meter. *For still greater sensitivity (from 5 at ASA 100) an accessory Booster, which slips in the accessory shoe base, is available.*

Single-Stroke Rapid Wind System *with 25° lever angle. The single (very short) stroke of the lever simultaneously advances the film, winds the shutter, counts the exposures and prevents accidental double exposures.*

4-Function Shutter Release Button. *When depressed half-way the f/stop appears in the finder. When fully depressed, it activates the shutter to take the picture. It is threaded to accept a cable release. If depressed and turned clockwise it will lock into position for time exposures.*

Unique Rewind System. *The Rewind Release Button is depressed once (it does not have to be held). It remains depressed until all of the film is rewound by means of a fold-away Rapid Rewind Crank. After the film is rewound, the button automatically resets itself. The red dot on the Release Button rotates clockwise to show that the film is being transported properly and counter-clockwise to show that the film is being rewound.*

Golden Frame Rangefinder-Viewfinder, *with automatic parallax correction, serves a multi-function. It frames the scene with a golden bright frame, it incorporates a precision coupled (super-imposed) rangefinder and shows the correct aperture automatically set for each exposure.*

Lens. Sharp, 4-element D Zuiko f/2.8, 45mm lens with focusing scale from 3.5 ft. to infinity. Plus, three click stop settings of "Close", "Group", "Scene".

Shutter. *Accurate Copal SV, MX full synchronization, from 1 full second to 1/500th second and bulb plus built-in self timer which is actuated by Shutter Release Button.*

Size. *Most compact, measures only 5¼ x 3¼ x 3".*

Weight. *Lighter than most 35mm cameras. Weighs approximately 1 lb. 6 oz.*

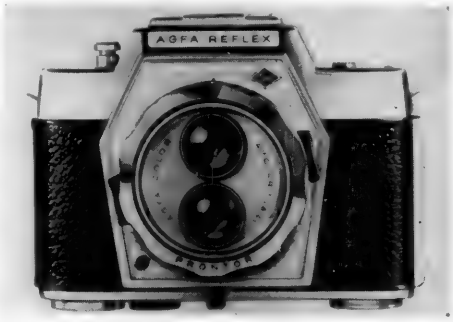
Complete descriptive literature is available from the dealer or by writing to: Scopus, Inc., 404 Park Avenue South, New York 16, N.Y.

NEW AGFA REFLEX CAMERA

An eye-catching new look characterizes the new Agfa Reflex camera.

The two lenses of this twin-lens 35mm reflex camera are set closely together, one above the other, within a larger circular metal frame. This gives the camera the appearance of having two small eyes within a larger eye.

Because of the closeness of the two lenses, there is practically no parallax, according to the manufacturer. And, of course, there is no black-out in the viewer shortly before picture



taking. This makes the camera more effective than a single-lens reflex camera. On the other hand, the Agfa Reflex has far less movable parts than a single-lens reflex camera, and, therefore, promises more trouble-free operation.

Moreover, while in many twin-lens models the viewing lens is of poorer quality than the picture-taking lens, the two Agfa Color Apotar f/2.8 45mm lenses of the Agfa Reflex are identical in quality.

The Prontor shutter provides speeds up to 1/500 seconds. A winding lever simultaneously sets shutter, transports film, and activates double-exposure prevention device and blank-safety lock.

The waist-level reflex viewfinder with split-image focusing provides a brighter image than could be obtained in a comparable single-lens reflex camera. There is a flip-up magnifier for critical focusing, as well as a sports finder for fast action pictures.

The suggested list price of the Agfa Reflex is $64.50 plus case. A special attachment for

close-up pictures from 15 to 32 inches is available as an optional extra. The attachment has two separate lenses fixed immovably on the same axis as the camera lenses.

Ketchum, MacLeod & Grove, Inc., Rainer Esslen, 155 East 44th Street, New York 17, N.Y.

NEW ENTECO "FILTER SELECTOR" CHART AVAILABLE

Enteco has ready for distribution, a new "Filter Selector" chart with abundance of filter information.

It contains data on filters, such as general description, purpose and effect for which they are used, the decamired values of light balancing filters, color temperature of light sources in kelvin degrees and their decamired values, etc.

The "Filter Selector" will help you to use proper filters for black and white and for color film.

The change in latest exposure indexes of color films, when used in different light conditions with appropriate filter, is clearly shown.

Also included in this chart, is short explanation of decamired filter system and their use.

This new Enteco "Filter Selector" chart is available free from your Enteco dealer, or by writing to Enteco Industries, Inc., 610 Kosciusko St., Brooklyn 21, New York.

ANSCOCHROME TYPE DUPLICATING FILM NOW AVAILABLE

Anscochrome Duplicating Film Type 544, a 35mm reversal color film designed for duplicating positive color transparencies and positive film strip originals, has been announced by Ansco, Binghamton, New York, the photographic manufacturing division of General Aniline & Film Corporation.

Anscochrome Type 544 is excellent for making "blow ups" from 16mm originals and may also be used for making prints directly from 35mm motion picture projection prints. It is compatible with Anscochrome film and may be processed in Anscochrome chemicals.

AVAILABILITY	List
100 ft. DRL (Darkroom loading)	$13.50
100 ft. DLL (Daylight loading)	14.65
OL (Odd lengths)—per ft.	.12

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Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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Volume 28, Number 4 November, 1960

JOURNAL *of the* BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

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Tables should be on separate sheets, each with self explanatory captions.

Reference notations in the text should be written as superscripts. Do not place in parenthesis. References should be on sheets separate from the text, numbered consecutively in the order of their appearance in the manuscript. Journal references should include: Author(s), title of article, volume number, page number(s), month and year. Book references: Author(s), title of book, edition, page number(s), publisher, year. Double space lines, triple space between references, 1¼" margins.

Illustrations should accompany the manuscript, preferably unmounted. They must not be larger than 14" nor smaller than 4" in maximum dimension, and should be properly proportioned to fit single column, double column or full page of the Journal. Identify each illustration on its back in soft blue pencil, giving title of paper, senior author and Fig. No. only. Legends should be on a separate sheet and each identified by Fig. No. matching its illustration. Double space lines, triple space between legends, 1¼" margins.

The editors reserve the right to reject manuscripts considered unsuitable. Major alterations of accepted manuscripts will not be made without permission of the senior author.

Special Note: If you have an idea or technique of importance to biological photography and need assistance in preparing the manuscript, write Editor.

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Journal of the Biological Photographic Association Vol. 28, No. 4, November, 1960

Technique of High Speed Photography of the Larynx

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IN 1940 the Bell Telephone Laboratories[1] described their epochal experiments photographing the human vocal cords at speeds of 4000 and more frames per second. Their motion pictures were a landmark clarifying innumerable features of laryngeal physiology and stimulating further research in this fruitful investigative approach[2].

In the method developed by the Bell Telephone Laboratories basic equipment consists of a high speed camera, laryngeal mirror, and powerful light source, all of which are in fixed position relative to each other (Fig. 1). The camera is aligned with the immovable laryngeal mirror through a hole in a much larger mirror. This larger mirror is set at a 45° angle and provides the co-axial light that is mandatory. The subject opens his mouth and is guided over the fixed laryngeal mirror until the larynx is visualized in the camera. When the desired view is obtained, the camera is activated by a switch and 100 feet of film are exposed in about one second. The larynx cannot be seen during the actual shooting.

Several years ago the authors undertook an investigation of the human larynx by high-speed photography, following this method. The resulting motion pictures were of excellent quality, but a single technical obstacle that could not be overcome in studying the mechanism of vocal registers necessitated the development of an entirely different setup. Many larynges which can be visualized when a mirror is introduced into the throat cannot be similarly exposed when the subject is brought over a fixed mirror. It requires both practice and patience to adapt a patient to this unusual type of mirror examination in which all adjustments must be made by manipulating the head rather than the mirror as a doctor does in his examination. In an apprehensive or gagging patient, in a child, and in the temperamental singer this is very impracticable and often impossible.

The series of experiments planned by us made it imperative that any larynx visualized in a doctor's office would be a suitable subject for high speed cine-

*From the Department of Otolaryngology and the Division of Laboratories, Cedars of Lebanon Hospital, Los Angeles.

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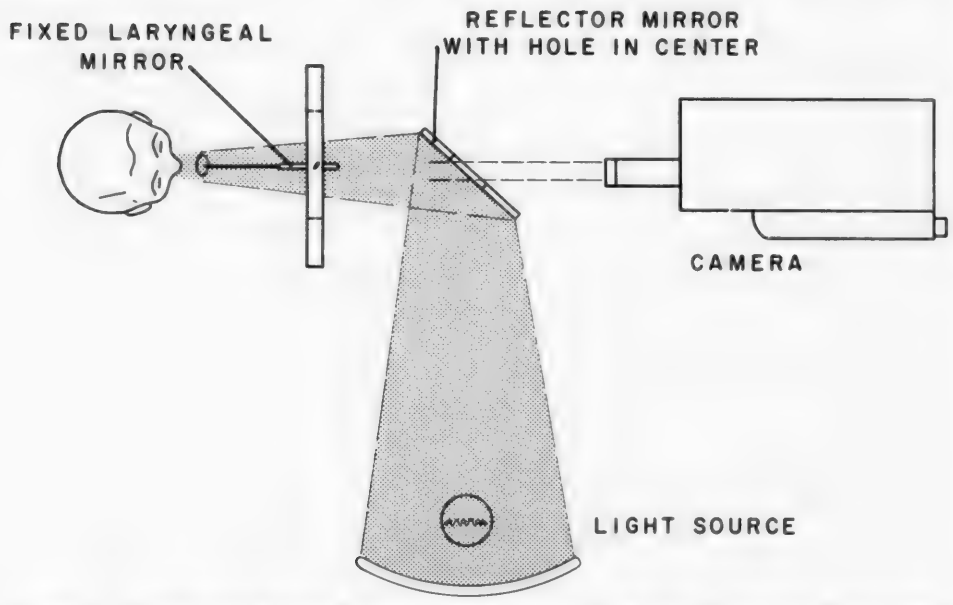

Figure 1. Diagrammatic sketch of the technique developed by the Bell Telephone Laboratories for high-speed cinematography of the larynx.

laryngoscopy. The ideal method would be one wherein nothing differed from a routine office examination.

In order to make cinelaryngoscopy similar to mirror laryngoscopy, a technique has been developed which is based upon the principle of a manipulative rather than a fixed laryngeal mirror. In our technique (Fig. 2) the physician holds the mirror in his hand, introduces it into the pharynx in the usual manner of mirror laryngoscopy, visualizes the larynx, and then photographs at high-speed what he wishes to record. To accomplish this, certain changes had to be made in the relationship of the camera and light source to each other and to the patient. The camera was mounted overhead at no sacrifice of accessibility or fixation. The light source was placed beneath the physician's seat and channeled via an enclosure to the larynx. The observer visualizes the larynx at all times through an optical view finder (Fig. 3) while most of the light from the laryngeal mirror is deflected upward into the camera. When the physician sees what he wishes, he steps on a footswitch which triggers the camera and increases the light intensity simultaneously. The laryngeal image remains clearly visible to the physician even during the period of actual shooting. The only limitation to the subject's movement is a flat head rest (as can be seen in Figure 2), thus allowing him to slip aside if he is uncomfortable.

Materials and Method

Camera

The camera incorporated in this unit is the Wollensak "Fastax" WF-4S. It holds either 100 or 400 foot rolls of 16 mm. film and is capable of stop-start runs at speeds up to 8000 frames per second.

Light Source

Since only one light source can be used in this particular arrangement, it must be very intense and, at the same time, relatively cool. Of the many lamps tested the Mole-Richardson Xenon lamp proved the most satisfactory. Although described as a cool light, its proximity to the subject produces too much heat for comfort. In addition, ultraviolet rays are emanated, and so special glass filters have been interposed to absorb both heat and the ultraviolet rays. The lamp is battery operated and has excellent color balance for daylight color film. When focusing and viewing, it produces an intensity of 17,000 foot candles in the area of the pharynx. A switch activated by the right foot intensifies the light to 275,000 foot candles at the instant of shooting. This flash is synchronized to trigger the camera. The burst of light can be set for a duration of 1½, 3 or 5 seconds. The unit for viewing and focusing is powered by 18 volts D.C., the bright flash by 42 volts D.C. The control panel (Fig. 4-S) contains the circuit for the lamp plus the synchroflash mechanism.

Path of Illumination and Reflection

Light is directed from its source in the Xenon lamp (Fig. 4-A) to the vocal cords in the following manner: The beam is focused to its narrowest angle and is first directed to a mirror (Fig.

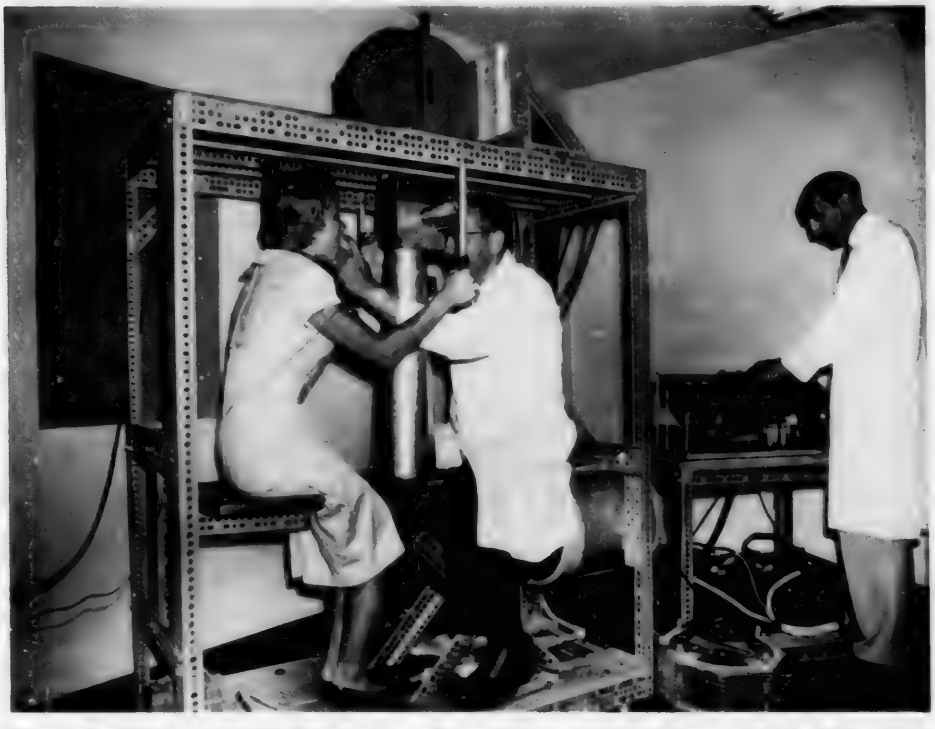

Figure 2. High speed unit showing overall appearance and relative positions of physician and subject.

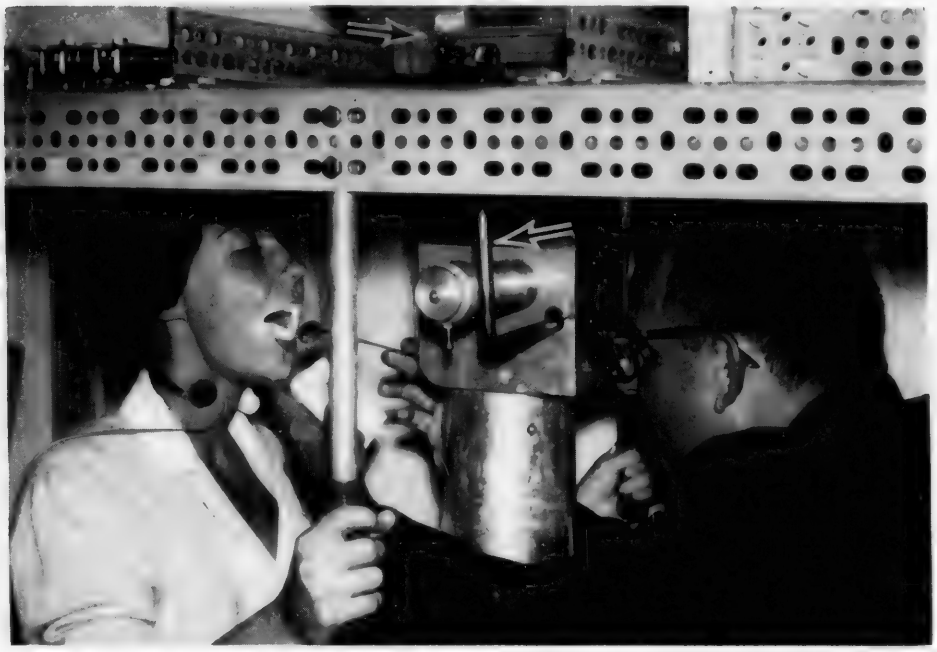

Figure 3. High speed unit in operation showing mirror being introduced and arrows point to the gunsight used as an auxiliary viewing mechanism by the photographer and the handle which permits rotation of the image splitter.

4-B). After experimentation it was decided to utilize a first-surface mirror because light passing through an ordinary mirror to the silver backing and then out again suffers an alteration of color balance and significant decrease in its intensity. This first-surface mirror is set at 45° angle and directs the beam of light upward through a tunnel formed by sheet metal (Fig. 4-C). The tunnel insures unobstructed passage of the light beam and shields the eyes of both doctor and subject. Near the top of the tunnel is a heat absorbing glass filter (Fig. 4-D). A circulating water filter was used originally but, while effective in cooling, it at the same time significantly reduced the light intensity. The beam of light then strikes a specially ground concave first-surface mirror (Fig. 4-E) to narrow it further. The mirror is set at a 45° angle and so returns the beam to a horizontal plane. It also has a hole in its center, the purpose of which will be explained shortly. The light beam now enters the mouth, strikes the laryngeal mirror (Fig. 4-F) and is directed downward to illuminate the vocal cords (Fig. 4-G). The diameter of the beam in the pharynx area is approximately 2 inches, and the laryngeal mirror may be held anywhere within this area during filming. After being illuminated by light deflected from the laryngeal mirror, the image of the vocal cords returns by the same mirror and passes through the concave mirror (Fig. 4-E) which has a hole cut out in its center. The purpose of this hole is to permit the reflected image to pass through to a beam splitter (Fig.

4-T). The light in its path from concave mirror (Fig. 4-E) to larynx may be encroached upon by teeth, tongue, etc. The most useable and constant light therefore is that closest to the center of the beam. Since this hole is in the very center of the light beam, it is essential that it be properly designed for minimal loss of light. The laryngeal mirror held at approximately 45° presents itself as an oval shape, and the best configuration for the hole is also oval. To accomplish this with our set-up a round hole was cut out of the mirror and, when this is tilted to 45°, it takes the shape of an oval. The optimal diameter of the hole in our unit is 25 mm.

When the reflected image passes through the hole and reaches the beam splitter (Fig. 4-T) (a partially aluminized mirror), 99% of the light is reflected upward to the lens of the camera and 1% continues straight on to an optical view-finder (Fig. 4-I) which gives the physician a magnified view of the larynx. Although the amount of light reaching the eye is only 1% of the total, it affords as much illumination as a head mirror and usual office light source.

The light reflected upward to the camera passes through an optically flat piece of glass (Fig. 4-J) which reflects a fraction of a percent of light along a tube having a first-surface mirror (Fig. 4-K) at its end. A hole in the top of this tube allows the photographer to visualize the laryngeal mirror and image at the same time as the physician.

Since the position of the subject is not stationary, the laryngeal image will not always occupy the center of the light beam. Moreover the position of the throat often shifts during actual photography. These factors will be manifested in the film as distracting movements and an off-center larynx. The photographer corrects this by manipulating the handle (Fig. 4-L) of the moveable beam splitter (Fig. 4-T) as he observes the larynx through his own mirror

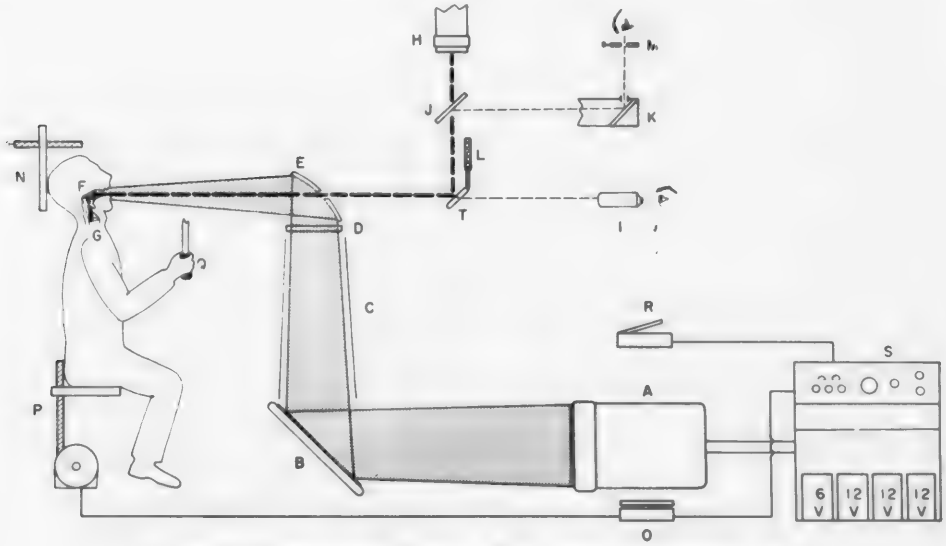

Figure 4. Diagrammatic sketch of high-speed photographic unit.

arrangement simultaneously with the physician. By means of a gun-sight (Fig. 4-M) which permits finely controlled adjustments, the photographer is able to "zero in" on the light beam as it strikes the beam splitter, detect any deviation in its desired axis, and keep the image centered as it passes upward to the camera.

Positioning of Subject

Given a non-stationary subject, a 135 mm. lens producing a shallow depth of field, centering and focusing seemed an enormous problem. The solution, however, proved to be fairly simple. A fixed headrest (Fig. 4-N) provides a definite position for focusing the camera on the vocal cords and yet allows lateral and rotary freedom of movement without altering the focal distance. The headrest unit consists of a board and screw assembly attached to the top of the frame. The back of the patient's head is in contact with the board at all times. This gives the patient a feeling of freedom from enclosures or clamping devices. He may move his head and slip away from the laryngeal mirror should there be any discomfort. While focusing, the patient's height can be rapidly adjusted by a reversing foot switch (Fig. 4-O) controlled by the physician which activates a motorized seat (Fig. 4-P). Two hand rests (Fig. 4-Q) are provided which the patient grasps for support. Switch (Fig. 4-R) controlled by the physician's right foot, starts the filming sequence by closing a circuit to the control panel (Fig. 4-S).

Construction

The framework for the assembly is constructed of a processed metal known commercially as slotted angle. It superficially resembles the parts in a child's erector set. The chief advantage of this material is the ease of attaching any number of components to the unit by making use of the recurring hole pattern (Fig. 5). Its versatility saved many dollars and untold hours of labor when compared with any other conventional structure. The proper lengths of slotted angle are quickly cut utilizing an angle cutter, and with the insertion of nuts and bolts in the recurring holes a strong bond is accomplished.

Film

For black and white photography we found Dupont Superior #4 to be the most satisfactory. It has an ASA rating of 320. For color we use Kodak Reversal Color Film SO 260, ASA Rating 160.

Initially we used black and white film in 100 foot rolls, but at speeds of 4000-5000 frames per second this is exposed in about one second and is therefore suitable for isolated phonatory bursts only. The study of vocal phenomena such as the falsetto "break" and co-

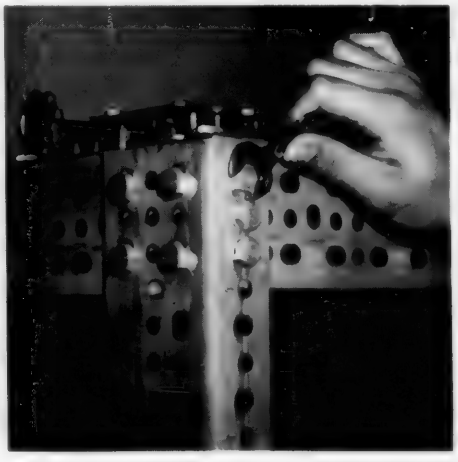

Figure 5. Slotted angle was used for the main structure assembly.

ordinated registration, or the mechanism of laryngeal closure in recurrent nerve palsy, requires a longer shooting time in order to capture the voice in continuity. This is either impossible with a one second exposure or requires such split second timing as to be impracticable because of the gross waste of film. For situations in which it is necessary to photograph a phonatory sequence we utilize film in 400 foot rolls. This allows three seconds of shooting time at 8000 frames per second and more at lesser speeds. Color film is used in 100 foot rolls only because the real value of color lies in demonstrating lesions and, for these, short phonatory bursts are sufficient. Color is not necessary for the study of laryngeal dynamics and it also involves far greater expense.

Speed

For ordinary vocal sequences speeds of 4000-5000 frames per second are adequate. However in studying the upper reaches of the voice, particularly of the female, and in the child, greater speed is necessary to effect slower movement of the vocal cords and permit close study of each vibratory phase. In these situations we shoot at 7000-8000 frames per second. It becomes imperative at these speeds that all available light be utilized to its maximum. Great care must therefore be exercised that such obstructing factors as an incomplete open mouth, prominent tongue or teeth, gauze around the tongue, a partially overhanging epiglottis, etc., do not encroach unduly on the light beam and critically reduce its intensity. These obstructing factors will occur without the operator being aware of it, and only experience will enable him to know what exposure is adequate for the best photography at the highest speeds.

Sound Recording

A tape recorder is synchronized with the camera, and a small throat microphone is secured comfortably to the subject's neck over one ala of the thyroid cartilage. This enables the voice to be recorded without undue background noise.

* * *

The principal advantages of this new technique are threefold: 1 — It makes available for high-speed photography subjects who otherwise could not be photographed or at best, with difficulty. Simulating the type of laryngeal examination employed by the laryngologist as a routine office procedure overcomes the problems attendant upon bringing the subject over a fixed laryngeal mirror and enables virtually any larynx which can be well visualized by mirror, to be photographed at high speed. 2 — Because the larynx remains in view during the entire period of actual shooting, it is possible to extend the scope of a study to include vocal sequences as well as single sounds, and films in rolls of 400 feet can be utilized. 3 — The increased light intensity resulting from efficient use of a more powerful source permits speeds up to 8000 frames per second and consequent clear delineation of individual vibratory phases in the highest reaches of the voice.

Utilizing this technique the action of the larynx in a wide range of normal and pathological situations is being studied. Figure 6 illustrates fundamental registration in a female vocalist. Figure 7 demonstrates fixation of one vocal cord by infiltrating carcinoma and normal vibratory activity of the other. Motion pictures on the neurochronaxic theory, the falsetto, and the mechanism of the larynx in health and disease have been produced.

Figure 6. Normal vibratory pattern at 6000 frames per second.

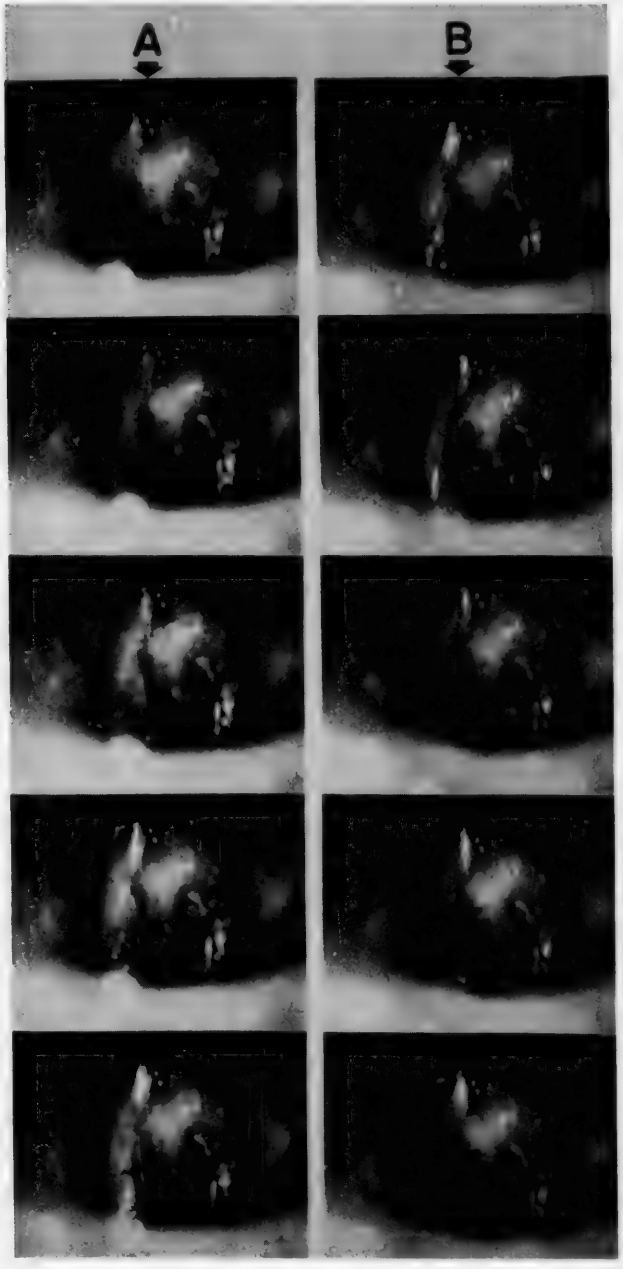

Figure 7. Infiltrating carcinoma of vocal cord interfering with normal mobility pattern.

Conclusions

1. A new technique is described for photographing the larynx at high speed. The camera is mounted overhead and projects into a beam splitter mounted between the patient and the doctor. This beam splitter can be rotated in any direction by means of an attached handle. During actual shooting the photographer, through an auxiliary viewing mechanism, is able to see the identical view and if movements occur in the position of the larynx he may correct this by manipulating the handle of the beam splitter.
2. By this technique the potentialities of high speed photography in studying the behavior of the larynx in health and disease are greatly enhanced.

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Mirror-Subject Photography

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MIRROR-SUBJECT photography is a novel way of showing simultaneously the subject and a mirror image. The front and back or front and side views of a patient or specimen may be shown. The mirror image may cover the whole subject or it may show only the area of interest.

Mirror-subject views have the advantage over ordinary photographs in that they show two views simultaneously. Therefore, such pictures tell the story in a single photograph. In addition, it is both a saving of photographic material and time. This method of case presentation is informative, instructive and unusual.

The mirror-subject method will demand on the part of the photographer the foresight and initiative to apply this technic to a suitable case with beneficial effect. For those who will employ this practice, it will be necessary to have mirrors of various sizes in the photographic department. Furthermore, mirror-subject photography should be made known to the hospital staff and featured as part of the photographic service.

Such photographs are attractive either in monochrome or color. The main requisite of success with mirror-subject photography is to be thoroughly acquainted with the technique and apply it intelligently to suitable subjects.

Mirror

The mirror image is an accurate reproduction of the subject but smaller, in proportion to the added viewing distance. The image is vertically erect, but laterally inverted, which means that the right and left sides are interchanged. When a mirror is horizontal, the image is vertically inverted and laterally erect. The position of the image is as far behind the mirror as the subject is in front, and a line joining the two passes through the mirror at right angles. The angle of reflection always equals the angle of incidence, and the incident ray, the normal, and the reflected all lie in the same plane.

A mirror is a polished surface which reflects light, and is usually made of glass which supports the silver coating. A plane mirror has a flat reflecting surface.

A first-surface mirror is usually made of glass and is coated on the front by silver, aluminum, or other polished metal. The glass is only a supporting base for the coating. Although this type of mirror is the most suitable it is easily scratched and damaged. Because the mirror coat-

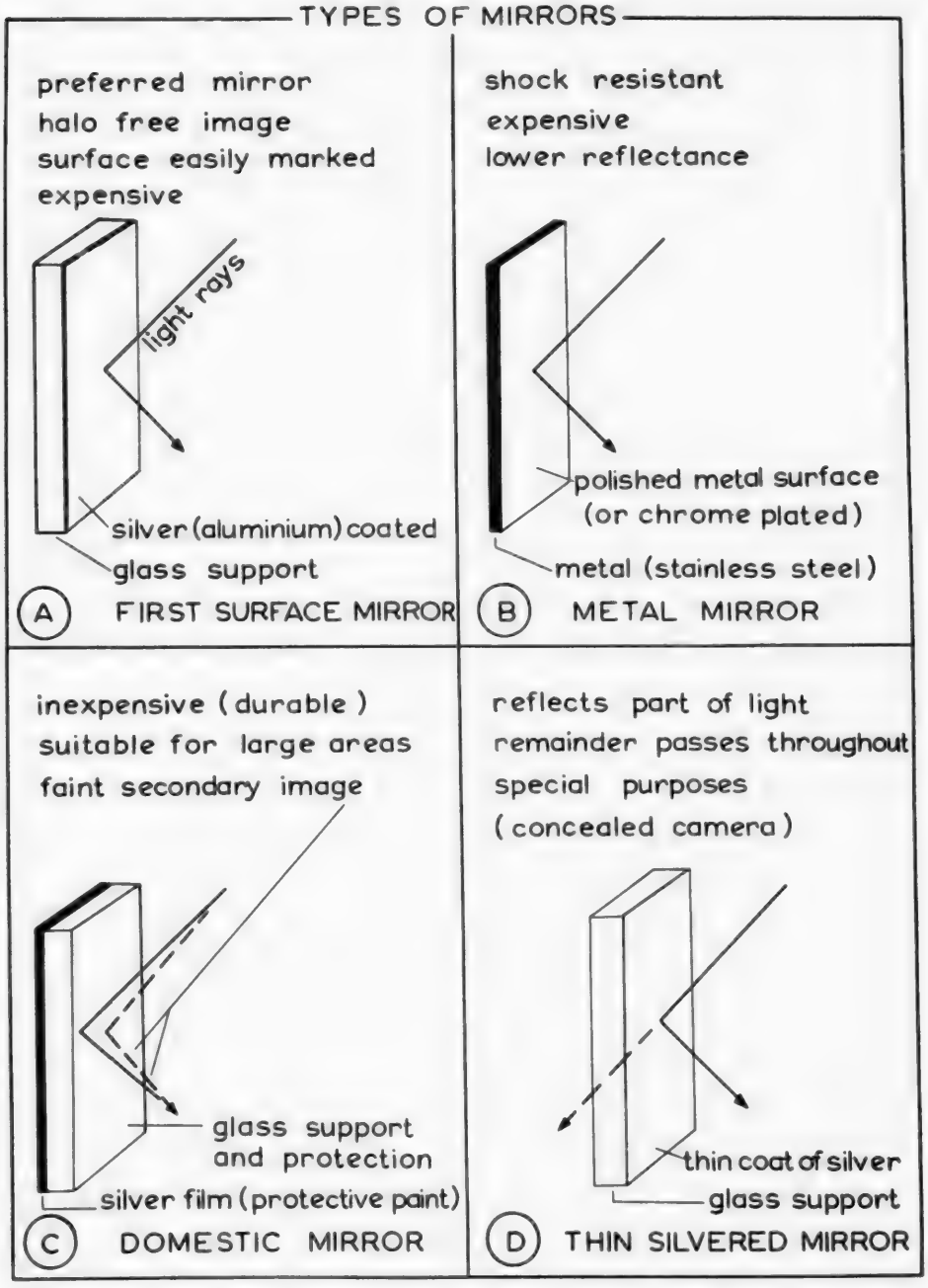

Figure 1. The choice of one particular type of mirror is influenced by the subject matter and the image quality.

ing is exposed to air the metal oxidizes and loses its reflectance in which case these mirrors must be recoated. First-surface mirrors are expensive and difficult to handle and are mainly used for small areas where maximum detail is important.

There are mirrors made of polished stainless steel or chromium plated metals. Their reflectance is lower than the reflectance of glass mirrors. They are not suitable for large mirrors because of their weight and expense. Their advantage lies in their being shock resistant. They can be used for photographing small areas, for children and for oral photography.

The glass mirror with the reflecting coating on the back is the best compromise for mirror-subject photography. It is inexpensive; it keeps its brilliance indefinitely; it is easy to handle and clean, and is durable. The only criticism of the glass mirror is that it gives a faint secondary image from the surface of the glass which, for ordinary photography, is negligible.

The thin silvered mirror is a glass mirror coated with metal in such a thickness that part of the light is reflected and part is transmitted. The amount of light transmitted or reflected depends on the thickness of the coating. These mirrors are not suitable for mirror-subject photography.

In summary, the glass mirror is the first choice. The first-surface mirror is preferred for close-ups, while metal mirrors are recommended for children and oral photography.

Mirror Position

The mirror is used to show an area which ordinarily cannot be seen in its entirety from one viewpoint. When photographing a standing or sitting patient the mirror is usually placed below or to the side of the area to be photographed. When the subject is lying on a stretcher or bed the mirror is easily placed on the far side of the subject. The mirror is held by the patient, an assistant or a retention device. The mirror is tilted forward, depending upon the camera position and the area to be shown. If any photographic equipment is seen in the mirror, the mirror may be adjusted or the equipment draped. The exact view is appreciated only on the camera ground glass.

The size of the mirror depends upon the area which is to be included and the distance between the subject and the mirror. The usual sizes for close-up areas are 2¼″ X 4″ to 5″ X 7″, while 8″ X 10″ to 18″ X 25″ are used for large parts such as head, abdomen and extremities. Very large mirrors are heavy, awkward and dangerous to handle. For special purposes they are mounted on the wall and used for full length patient photography.

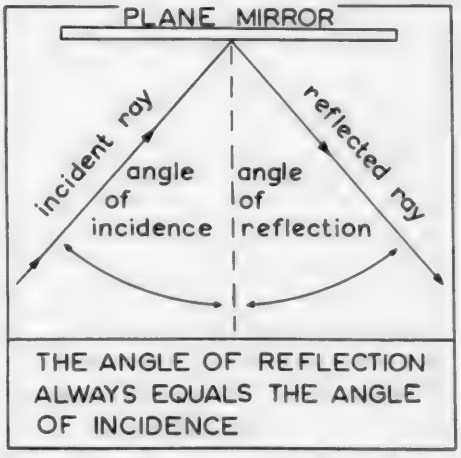

Figure 2. The reflection of light by a plane mirror.

Figure 3. Mirror size — (A) A large mirror positioned behind the leg to show simultaneous views of back and front. (B) A small mirror used to show the area of interest only.

Figure 4. A mirror-subject photograph. Notice the faint halo effect caused by the domestic mirror.

Lighting

For mirror-subject photography a continuous light source will allow the photographer to study the images on the ground glass screen. Only on the ground glass is it possible to properly evaluate the light distribution, depth of field, and mirror image.

Photoflood lighting is the preferred light source. For children and older patients electronic or expendable flash is preferred. A modelling light is helpful in detecting and correcting unwanted glare, shadows and reflection, and in improving lighting. The lighting arrangement for mirror-subject photography should be such as to illuminate the subject from the front, as well as the aspect of the subject reflected by the mirror. It is usually necessary to have at least three light sources, two from the front and one from behind or side which makes lighting more elaborate than is usually the case in record photography. However a flat specimen may on occasion be photographed with only one lamp from above. Subject-mirror photography has the advantage of showing two views of the subject in one photograph. In conventional photography to get the same view coverage it is necessary to take two separate pictures. In mirror photography the spotlight is difficult to control; it tends to produce a glare in the mirror and when a glass mirror is used the halo effect is exaggerated especially against a black background. A glare may be displaced by changing the lighting or mirror angle.

Background

The background for the subject is arranged as in ordinary photography. The black background is suitable only when the subject outlines are well illuminated. With frontal illumination

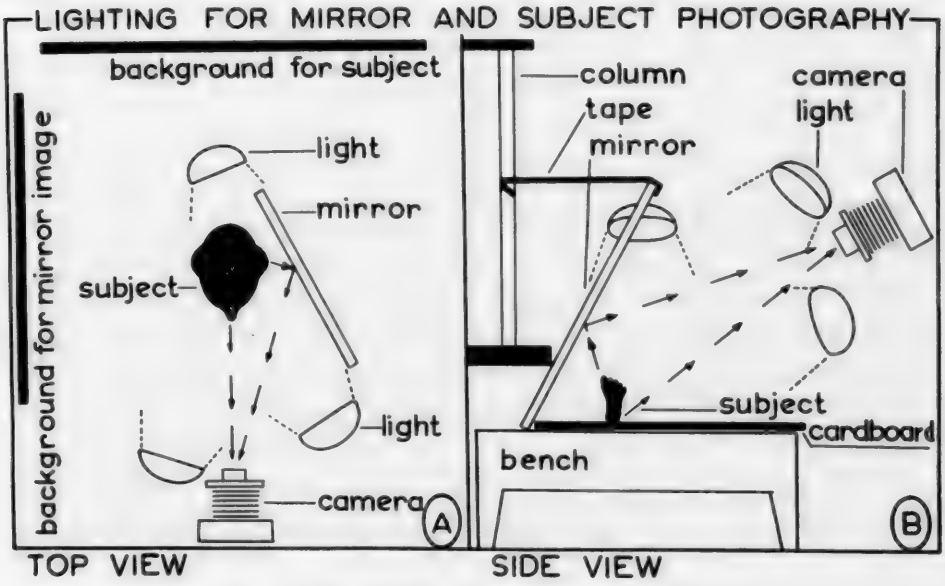

Figure 5. Arrangements for mirror-subject photography.

light backgrounds are preferred. With colored or light backgrounds separate background illumination will emphasize subject background separation and, in addition, will subdue or eliminate any shadows which may be cast by the mirror or its support. The background should be large enough to include both the subject and the mirror.

For the mirror image it is necessary to have another background because the mirror will reflect one side of the subject and the background behind it, depending upon its position and angle. This background may be the same color and tone as the background for the subject. More often, it is simpler to leave this background black by not lighting this area and by removing any objects which might catch light.

When the mirror is behind and above the subject, the background is the area around the subject, which may be a cardboard paper for a specimen, or a sheet or blanket for a patient in the prone position. Depending on the mirror tilt, subject or mirror distance and camera position, varying amounts of background area are used which are chosen when arranging the subject-mirror-camera.

If a tripod leg or light stand are reflected in the mirror, they may be eliminated by wrapping these parts with black cloth. The foreground may have to be extended and even tilted upwards to provide a complete background for the mirror image. This additional foreground will give additional scope and freedom in tilting the mirror. In color photography, backgrounds of neutral colors are usually preferred.

The junction between the subject and the mirror image can be accentuated by tape or by adding a light or dark line.

Figure 6. (A) Continuous background for mirror-subject photographs. (B) A mirror-subject photograph in which the mirror edge is shown.

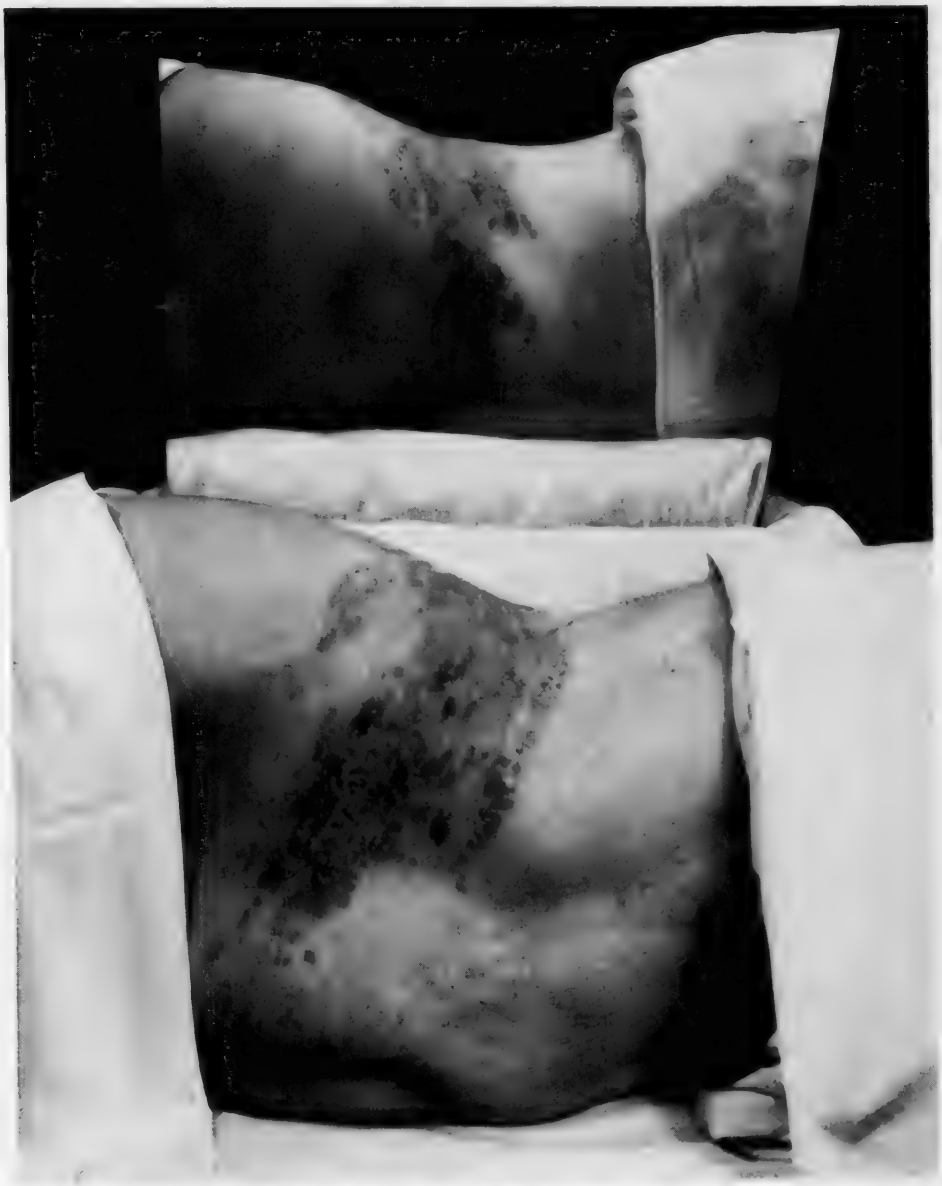

Figure 8. Herpes Zoster (Shingles) An example of a lesion which is well illustrated by mirror-subject photography.

This dividing line usually helps to distinguish between the subject and mirror image. For further clarification, it is well to include in the legend an explanation as to which is the mirror image. Whether or not to have the dividing line will depend on the subject matter and the desired effect. The junction between the mirror and the background may also be blended, especially with a black background, by running the background a little over the mirror. By this method a continuous foreground and background will be shown.

Focusing

In mirror-subject photography both the subject and the mirror image must be in sharp focus. To achieve this it is necessary to have sufficient depth of field which necessitates the use of a small lens opening and reference to the depth of field scale for the lens. The shorter focal length lenses are an advantage. The image reflected in the mirror must be regarded as being as far behind the mirror as the subject is in front. Therefore, it is easier to bring the subject and mirror image into focus when the mirror is close to the subject. In most instances it will be sufficient to focus these images equally on the camera ground glass screen. The lens is stopped down to bring both images into focus.

In photography with flash illumination the distance setting is found by referring to the depth of field scale after measuring the camera-subject and camera-mirror image distances. The depth of field scale will also give the required lens opening. In practice, lens openings of F:16 or F:22 are needed to bring both images into focus.

Conclusion

Mirror-subject photography offers the photographer the opportunity to add interest, information and impact to his photographs of subjects in which it is advantageous to photograph two sides simultaneously.

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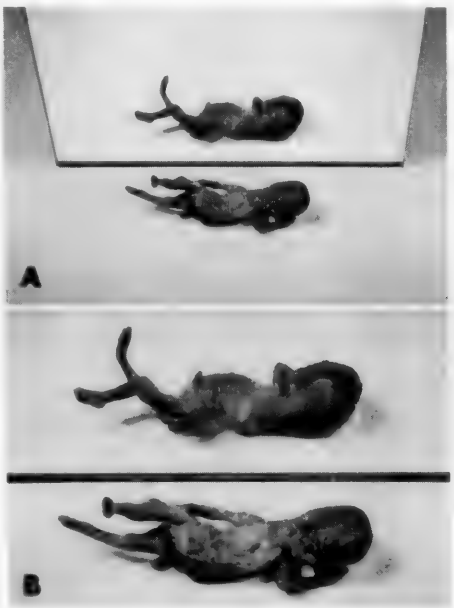

Figure 7. (A) A general view of the specimen and mirror. (B) The field used for the final mirror-subject photograph.

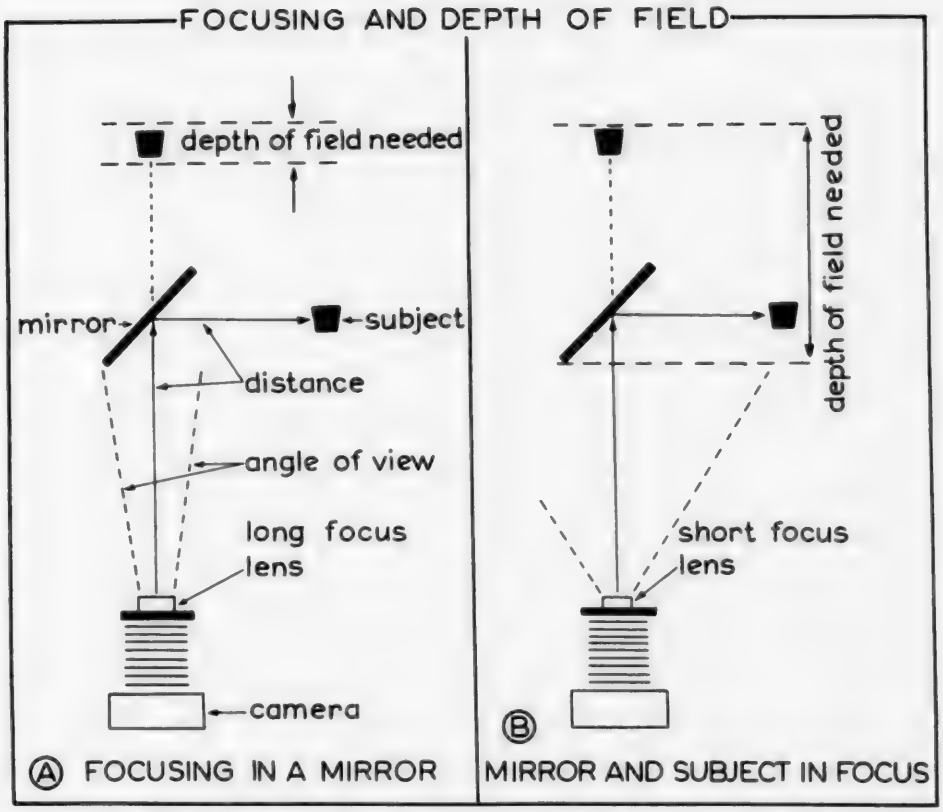

Figure 9. (A) Depth of field needed for photography in a mirror. (B) The increase in depth of field necessary for mirror-subject photography.

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A New Concept in Postgraduate Medical Education

Videotape Exchange Program of Postgraduate Medical Education for Open-Channel TV

Transmission

The Council on Medical Television, with the aid of a grant from Eli Lilly & Company, will initiate a project intended to develop and expand the use of standard broadcast televison as a means of supplementing the continuing education of the nation's practicing physicians.

During the first phase of this project, each of three medical schools will prepare a "course" consisting of 4 half-hour segments, or "cores", recorded on Videotape. A syllabus, containing self-testing material to supplement each televised presentation, will be prepared also. These courses will be designed primarily for the general practitioner. Production, distribution and transmisson will be handled by the National Educational Television and Radio Center (NET) and its affiliated stations. The cores will carry an acknowledgement to the Pharmaceutical sponsor but no product advertising.

After each school has shown its own course in its local area, an exchange of Videotapes will begin — ending after each school has had an opportunity to show all three courses. During actual transmission, each half-hour core will be augmented by an additional half-hour of introduction and discussion by local medical educators. In this way, any school will be able to participate actively in course presentation even though they may not have been involved in program production. Whenever practical, an "in-person" seminar will be scheduled at the medical school after each televised course.

As soon as a course has been recorded on Videotape, the NET Distribution Center will make kinescope copies (16 mm films) for viewing by medical schools who may wish to: 1) consider producing similar programs, 2) "preview" available material prior to local TV transmission, or 3) use the films for postgraduate teaching in the same way as regular medical motion pictures. These films will also be available to medical societies, organizations, meetings and small groups of physicians in rural areas.

Ultimately it is hoped that, by expanding this concept and initiating registration fees, medical schools will realize revenues that can be used to develop and support their postgraduate education divisions. Decisions concerning registration fees will, however, be up to each individual school. The Council is contacting its 47 member medical schools to determine their interest in participating in this project.

The Council on Medical Television is a national membership organization sponsored by the Institute for Advancement of Medical Communication; Frank M. Woolsey, Jr., M.D., Chairman of the Council and John K. Mackenzie, Executive Secretary.

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RICHARD H. ORR, M.D.
Executive Director

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Macrophotographic Illustration by Transparencies in Modified Registered Combination in the Medical and Biological Museum

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PHOTOGRAPHIC illustrations in the medical and biological museum usually comprise prints, lantern plates, or one of the standard sizes of colour transparencies. The subjects are often those which require enlarged images, e.g. entomological specimens, embryonic material, and small objects or organisms. In most case these subjects are improved by being shown as large transparencies, i.e. between 10″ x 12″—16″ x 20″. Apart from brilliance and range of tone the enhanced plasticity of the transparency is particularly effective and generally superior to the paper prints. For the methods described here, recently produced translucent materials suitable for large prints have been used with satisfactory results (e.g. Kodak Translite and Mimosa Opal films).

Experiments were designed to extend the use of these translucent materials for macrophotography of embryological specimens particularly, and to provide more effective and stimulating illustrations for the museum of human anatomy. A considerable increase in the plasticity of the image and therefore a more striking display could be effected by a combination method whereby two dyed and toned transparencies were superimposed in modified registration.

Material and Methods

The objects were photographed on 35mm film with a 25mm Leitz Micro Summar at f24 by means of the apparatus shown in Fig. 1. The Micro Summar was adapted to the Leitz focussing ring, which allowed fine focussing, and fixed to the extension bellows with a 5 cm extension ring. A Fisher clamp was used to hold the forceps retaining the object in any preferred position. In most cases the forceps may be shown in the photograph and serve to increase the apparent depth of the image, Fig. 5. Two lamps were used, a microlamp and a high intensity freely adjustable Zeiss hammer lamp for modelling.

A projection print, 10″ x 12″ up to 16″ x 20″ was made of the negative on the translucent film; with the enlarger raised 1·2 cm a slightly larger sharp second print was made. The first print was then toned sepia and the second print dyed red by the use of a mordant bleach and redevelopment in

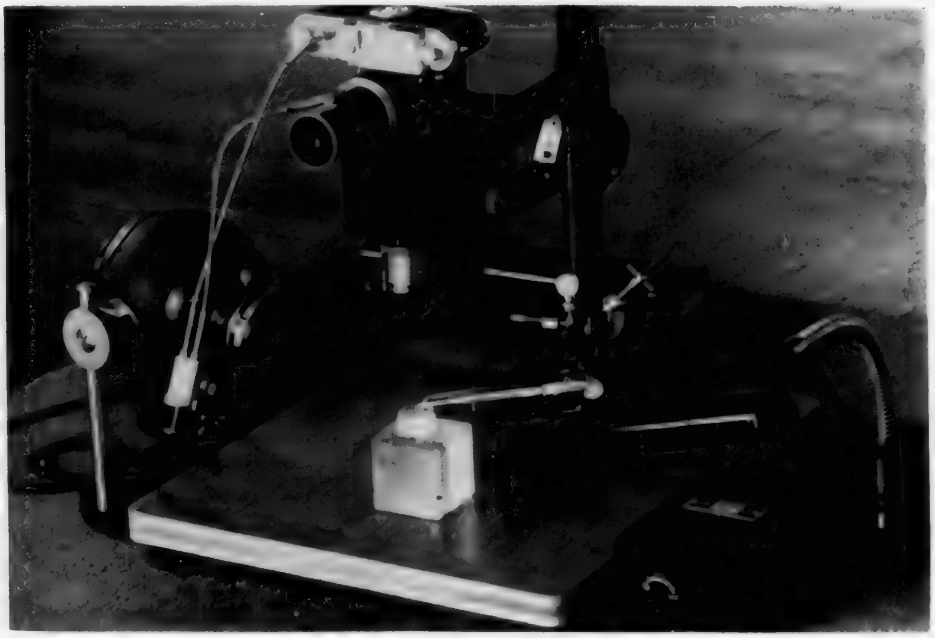

Figure 1. Apparatus for photomicrography of specimens uses standard components: forceps (held by Fisher clamp) used to retain position of small embryo immersed in water in perspex box mounted on a glass block.

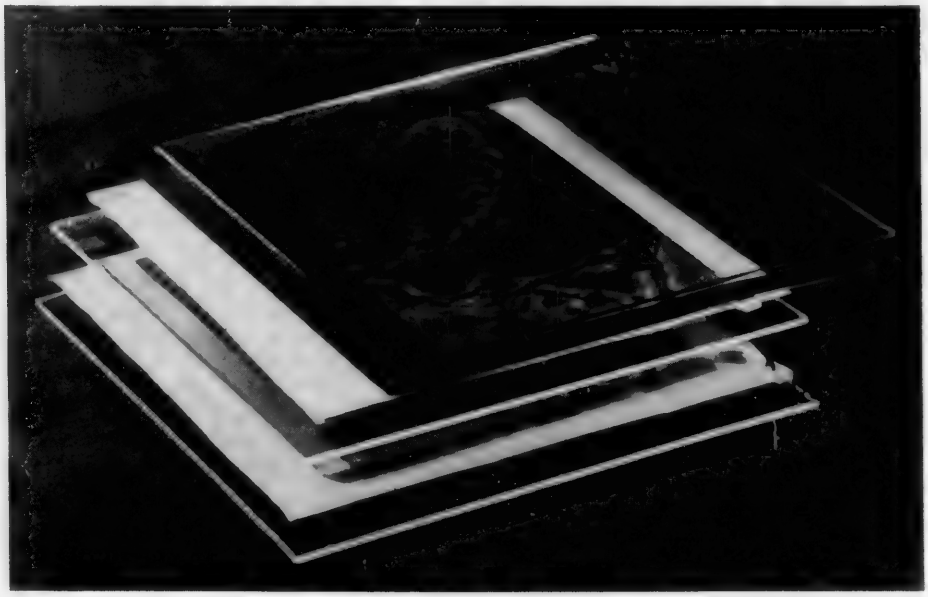

Figure 2. Exploded parts of combination prints from the top comprise: protective glass, mask, top (sepia) print, 3mm spacer sheet, lower (dyed) print, 3mm perspex backing.

1:1000 Safranine A. The second film was then backed with a 3mm sheet of perspex and covered by a 3·5mm perspex sheet to act as a spacer. The first (sepia) print was laid on this sheet in approximate registration with the second print; accurate registration was not possible owing to the spacing and slight size difference and was not in any case necessary. The top film was cov-

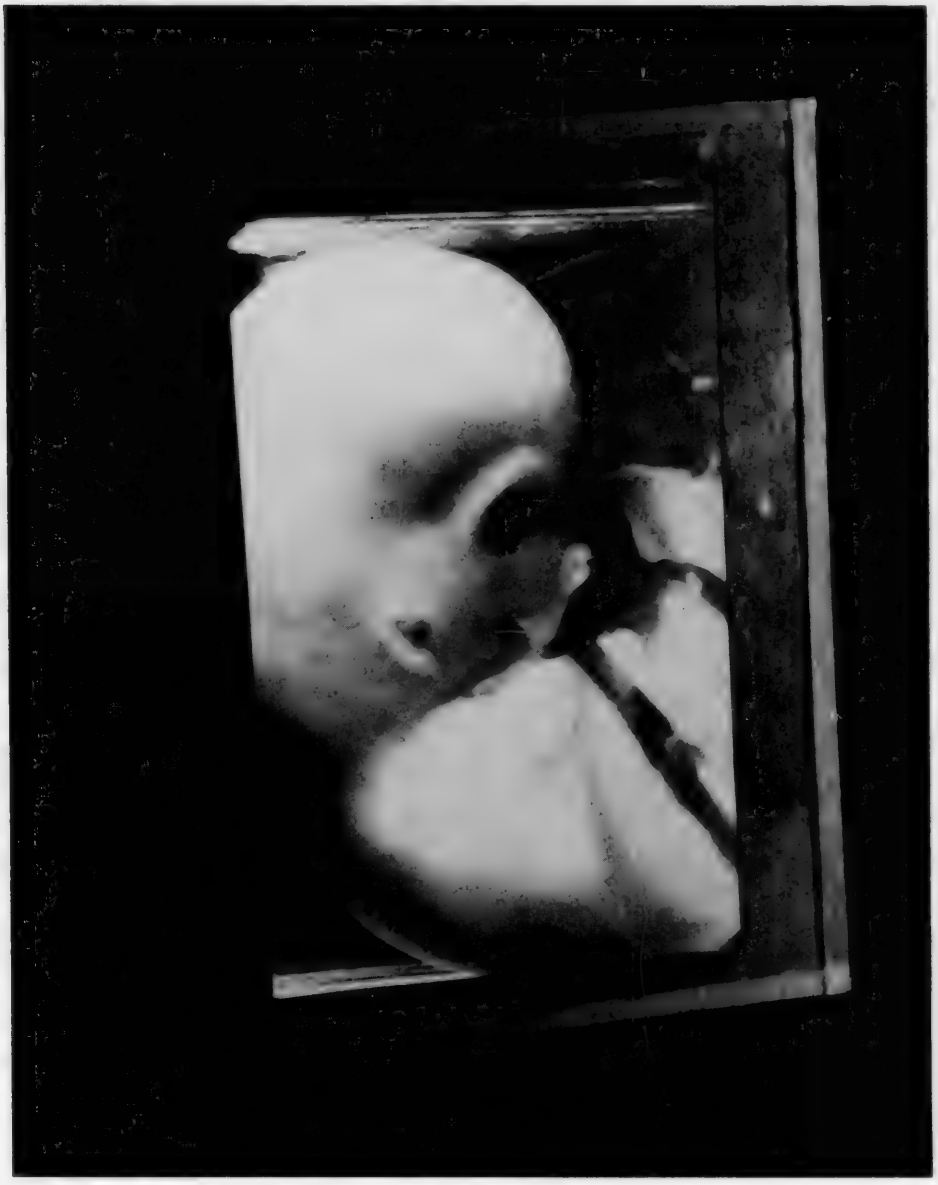

Figure 3. Layers of Fig. 2 bound together with tape.

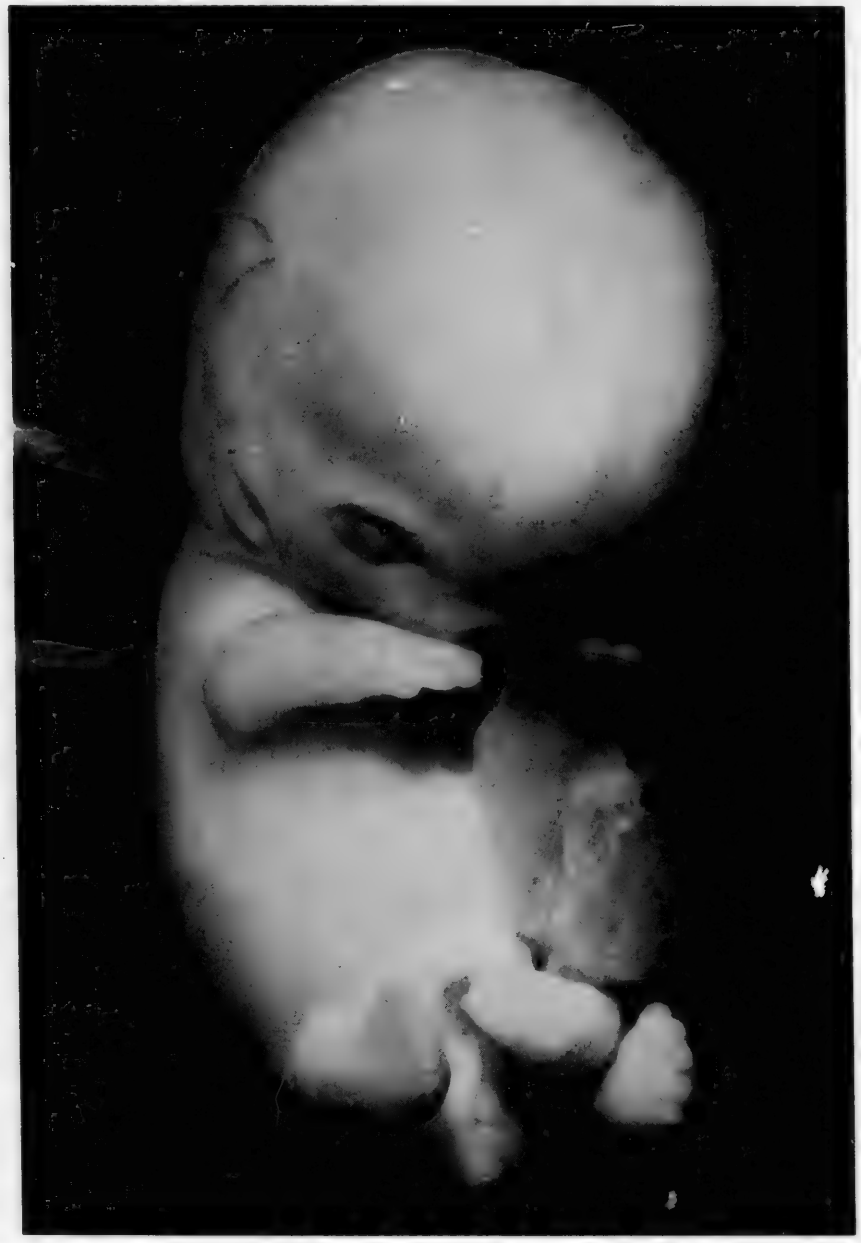

Figure 4. Typical specimen which gives satisfactory display; it should be noted that the embryo is turned in a three-quarter front view to increase plasticity; usually such scientific illustrations are lateral, full face or back. x 16.

ered by a mask and a thin protective sheet of glass. These layers, Fig. 2, were then bound with tape as are lantern plates, Fig. 3. The combination can be viewed with an X-ray illuminator or a similar type of large transparency viewer.

Results

The plasticity of the resultant image was greatly enhanced and was especially effective for embryological material of the type shown in Figs. 4 and 5. Neither spacing nor register was critical. A print on Kodak Translite or Mimosa Opal did not allow a sharp image of the lower print to show through; the lower print therefore appeared out of focus and at an indeterminate distance behind the top print. The most effective image spacing may be determined by experiment in each case since it seemed to vary, within narrow limits, according to the subject, contrast, and size of the print. It should be noted that the apparent stereoscopic effect became more marked after about 10-15 seconds observation.

The effectiveness of the display was improved when the films were dyed and toned, because the image acquired a more natural colour and pleasing depth than it had in black and white. Less satisfactory results were obtained in trials with the old two colour processes, i.e. photography with red and green filters and subsequent print dyes in complementary colours. However

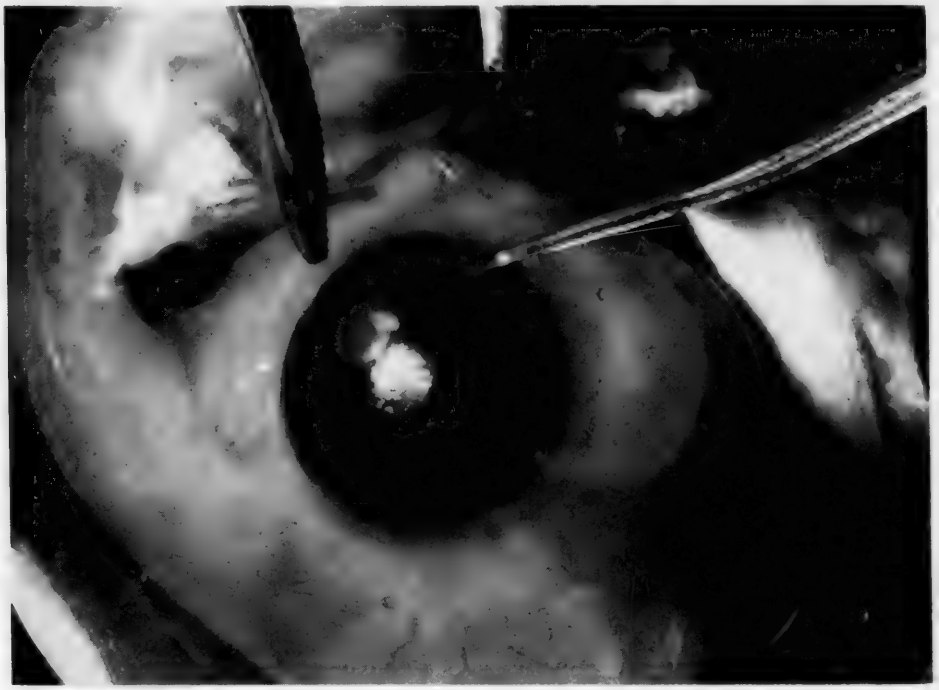

Figure 5. Macrophotograph of stage in graft operation on the eye of an embryo; to increase plasticity the forceps are included in foreground though not strictly necessary for information x 24.

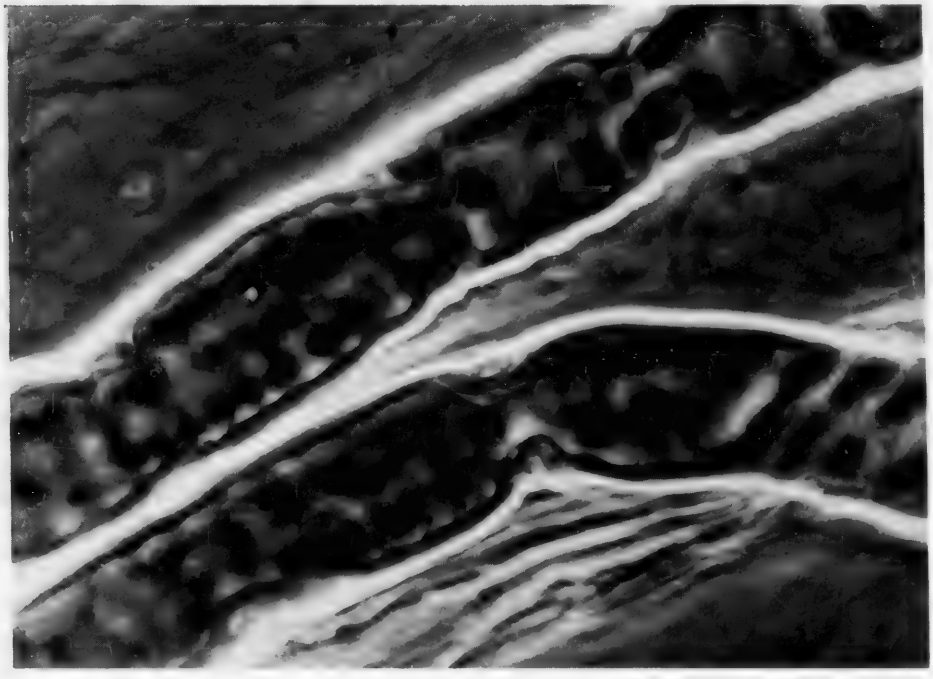

Figure 6. Two unstained living nerve fibres showing early degeneration. Phase contrast, x 5000.

two colour processes should not be completely discarded since it is possible that they may be effective with some photomicrographs of stained tissue sections.

Subjects which were found especially suitable for display by these methods of combination dye and sepia transparencies were mainly those which required macrophotographic reproduction, i.e. image enlargements between 5 and 25 times, Figs. 4 and 5. The display of some photomicrographic subjects at high power could be improved by these methods also; Fig. 6. The best results were obtained when the material was fairly "open" and when there was not much detail to be seen in the field. The plastic effect is independent of the original magnification; for example, the two unstained living nerve fibres in Fig. 6 are high power oil immersion phase contrast photomicrographs at x 5000 of a small area of the field; the result when mounted is similar in apparent stereoscopy to the macrophotograph of the embryo at x 16 in Fig. 4.

Summary

Effective museum photographic illustration may be achieved by the use of appropriately dyed and toned translucent photographic prints combined in approximate register which produce an effect of stereoscopy when viewed by transmitted light. Most suitable for display are macrophotographic subjects, especially small embryos. The same method may also be used with some high power photomicrographic subjects where they do not show a too complex pattern.

Journal of the Biological Photographic Association Vol. 28, No. 4, November, 1960

Electronic Flash in Medical Photography

FRANK J. REINDL

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WE have used electronic lighting routinely in medical photography and wherever possible with specialized cameras and in some research projects since 1953. We consider it a very important tool in the field of Medical Photography. The modeling and flash tube lights are cool and comfortable when photographing patients. Electronic lighting stops all motion whether it be in a patient, an animal, a living organism or a nervous camera man. The light output is very consistent and the illumination is bright enough to establish a basic technic with a small lens opening for use with color film.

Electronic lighting is portable and versatile because it can be used as: (1) flood lighting with standard type reflectors, (2) As a spot light; for this purpose we converted a Bardwell McAlister keg light with flash tube and modeling bulb (Fig. 1). (3) As a transilluminating light, with or without reflectors, depending on brilliance required. (4) As direct lighting, by use of an electronic ring light or through the lens prism lighting. (5) As indirect lighting by use of electronic bounce lighting. A single power pack will perform the various types of electronic lighting mentioned.

In routine medical photography, we have initiated a chain technique, as a standard for exposure with electronic lighting. Each electronic light has a six foot length of light weight chain (window sash chain) attached to the reflector, Figure 1. The photographer can raise or lower the electronic lights or move them from side to side for proper illumination as long as the electronic lights are at full chain length from the subject to be photographed. The background illumination is usually sufficient with this light source. At full chain length, six feet, the basic exposure for color film Kodak Ektachrome type B with 85B filter is F16 open flash. With black and white film, Kodak panatomic-X, the basic exposure is F32 open flash. The reason for open flash technique is to avoid the shutter contact points from becoming pitted or corroded and thus getting out of synchronization. Another reason is that some of our shutters are not synchronized for electronic lighting. With this chain length method, the medical photographer can deviate his technique to suit his personal lighting preference.

In full length and close-up photography of patients, animals, surgical and pathological specimens, normally two electronic lights are used at the full chain length position. Surgical and pathological specimens are placed on a plate glass specimen stand with various

Figure 1.

color backgrounds, twelve inches below the glass, (Fig. 2). The same two electronic lights illuminate the background. The settings with open flash are Ektachrome F16, Panatomic-X F32.

A surgical specimen superimposed on an x-ray is photographed by placing the x-ray on the plate glass of the specimen stand and covered with a piece of thin glass to avoid damaging the x-ray. The specimen is placed in the same anatomical position beside its outline on the x-ray. An electronic light is placed on a white background below the x-ray for transillumination. A black cardboard mask frames the x-ray to eliminate stray light. From here on the procedure is the same as photographing a specimen and the basic exposure is the same.

For extreme close-ups of the skin, intra oral lesions and in-situ photographs in surgery or in the morgue, we have built a prefocus electronic ring light camera. Mr. Leonard Hart has presented a paper on this camera previously, which will be published subsequently.

In infra-red photography of patients, two electronic lights are used. One on either side of the patient at a 22½ degree angle at full chain length. Four electronic lights have been tried but equally good results are obtained with two. The basic setting with Kodak infra-red film is F16, 89B filter, with open flash.

Photographing models made of plastic, plaster, acrylic, wax, etc., the adapted electronic keg light is used for the main

source of illumination. The fill light is a standard electronic light, with or without reflector. The basic setting with electronic keg light at ½ chain length (3 feet) and electronic fill light at full chain length (6 feet), is Ektachrome F16, Panatomic-X F32, open flash.

Electronic bounce lighting eliminates the highlights in photographing instruments, such as surgical and dental tray set-ups. A white bed sheet is shaped in the form of a tent or umbrella and hung from the ceiling. The instruments or tray set-ups are placed on the specimen stand or floor directly beneath the sheet. Two electronic lights with reflectors are placed on opposite sides of the instrument set-up at full chain length and also full chain length height from the floor. The electronic lights are angled toward the bed sheet, so that the instruments receive the bounce light at its maximum. The basic setting for Panatomic-X film is F11 open flash.

In making copies of drawings, charts, EKG's, books, etc., we have improvised an old Robertson 8 by 10 copy stand. A 5 by 7 inch Deardorff camera with revolving back is mounted on a lab jack bolted to the copy stand (Fig. 3). Two electronic lights are attached to ¼ inch curtain rods which in turn are bolted to the copy stand. The rods are so bent so that each electronic light is at a 45 degree angle from the copy board at ½ chain length (3 feet). The basic photographic setting depends on the type of film required. Examples: Process film, Ansco Reprolith F11 with open flash, Kodak Panatomic-X film, power pack at ½ power, F32 open flash Color Ektachrome film power pack at ½ power F16 open flash.

In copying x-rays and making dupli-

Figure 2.

cate color transparencies, a different set-up is used on the copy stand. A wooden frame holding two sheets of 14 by 17 inch glass, one opal glass in back, the other clear glass in front, takes the place of the copy board. An electronic light is mounted directly behind the frame with the same type curtain rod used previously at ½ chain length. The basic setting for normal x-rays on black and white film, Panatomic-X, is F16 open flash. For making duplicate color transparencies or enlarging 35mm to 3¼ by 4¼ inches or vice versa, the x-ray frame is illuminated and a similar smaller frame is inserted with a 35mm or 3¼ by 4¼ inch mask. The basic setting for 1 to 1 copy in color, Ektachrome F16 open flash. We have found that in enlarging 16mm color movie film to 35mm transparencies, electronic lighting will eliminate the surface scratches.

For photographing test tubes, specimen bottles, etc., the copy stand is used. The same procedure is followed as in copying color transparencies except a proper size mask is used for the various size tubes or bottles. There are occasions when two fill electronic lights are required for surface illumination besides the trans-illumination. The basic setting, with or without surface illumination, is Ektachrome F16, Panatomic-X F32 open flash, at full chain length.

In retinal photography, the Bausch and Lomb retinal camera was formerly used with carbon arc illumination. Now, the carbon arc light has been replaced by an electronic quartz tube. By utilizing a repetitive or continuous electronic light unit for focusing, the patient's eyes do not tear or become irritated and the patient is relaxed and comfortable. After the medical photographer has adjusted

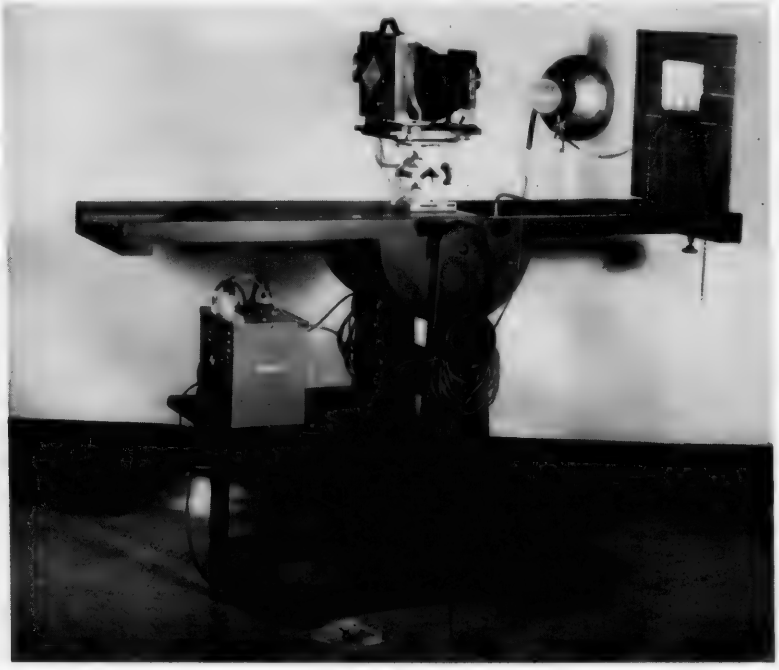

Figure 3.

the light and focused the retinal camera, the exposure is made through the power pack at ½ power, when using Ektachrome 828 roll film or Panatomic-X film.

Electronic lighting has been used in a number of research projects. For example: In the Ouchterlony agar-gel precipitin plates project, the research biochemist required black and white photographs of the fine precipitin lines around the antigen antibody wells. After some experimental lighting and exposure problems, we arrived at this set-up on the copy stand. One electronic light with reflector was placed 12 inches and approximately 60 degrees off center behind the plate. A mask, the size of the plate, covered all extemporaneous light. The camera was set for 1 to 1 magnification. The basic setting with Panatomic-X film was F11 open flash.

In the esophageal varices study, a simple clearing technique was devised and photographs in color and black and white were requested. The Pathologist wanted to show the venous pattern of a transparent esophagus suspended in benzine. After some experimenting, a dental instrument tray was used for holding the esophagus in suspension on the specimen stand. A mask was placed under the tray to eliminate extemporaneous light. One electronic light, without reflector was placed below the tray on a white background for transillumination. Two electronic lights with reflectors were placed at an angle of 45 degrees on both sides of the tray for surface illumination at full chain length. A metric ruler was drawn on the bottom of the tray in order to show the size if the specimen and a piece of clear glass was placed over the tray in order to confine the benzine fumes. Basic setting for Ektachrome F16, Panatomic-X F11, open flash.

In conclusion, the use of electronic lighting eliminates the discomfort to the patient that was caused by the bright illumination and heat, from the photoflood lamps. Electronic lighting eliminates blurred images due to patient movement and equipment vibration. Use of the chain method with electronic lighting eliminates basic photographic exposure problems and still gives the medical photographer a creative lighting technique. The variety of electronic lighting can be accomplished with a single power pack. (Speedotron power pack model 800C.) Electronic lighting equipment can pay for itself in a short time because it eliminates retakes.

Applications are invited for the position of Director of Department of Medical Art and Photography at the University of Minnesota Medical Center. The department is completely equipped for all facets of Medical Art and Photography, has been in existence for 5 years, and has 14 employees. Please submit complete resume of education and experience with your credentials and state salary required. All inquiries should be addressed to: Dr. Wesley W. Spink, Professor of Medicine, Mayo Memorial Building Room C-315, University of Minnesota Hospitals, 412 S.E. Union St., Minneapolis 14, Minn.

A Collection on Radiography History

The George Eastman House, Rochester, N.Y., announces the establishment of a collection on the history of radiography, comprising apparatus, books, periodicals, and radiographs. Through the gift of Mr. Arthur W. Fuchs, a splendid nucleus has already been established; it is hoped that radiologists and technicians throughout the country will add to this nucleus to form as complete a collection as possible of this important field.

In making his gift, Mr. Fuchs stated: "the whole story has yet to be told. The occasion for this situation is due in large part to the fact that there has not been a single repository of historical material of any sizeable volume to make it worthwhile to researchers in the field.

"Perhaps the years have passed too swiftly or the tendency to discard the old and take on the new has caused much of the old apparatus, radiographs, tubes, books, and journals, and analecta to disappear from the scene. What is left is scattered about the country and perhaps slowly deteriorating because of lack of care, except for those isolated instances where it is housed in some sort of museum."

The George Eastman House is a museum of photography, opened in 1949 in the residence of George Eastman in Rochester, N.Y. It is an independent non-profit educational institution, chartered by the Regents of the State of New York. Its collection of historical photographs, motion picture films, apparatus, books, manuscripts and documents on the history of photography is unique. A permanent exhibit of the history of photography is maintained, supplemented by frequent special exhibitions. Since its opening in 1949 over 2 million visitors from all parts of the world have seen the displays.

Frequent special exhibitions are held by the museum; many of them are circulated throughout the country. These exhibitions are made up of original material from the museum's vast collection, or borrowed for the purpose.

The Library and collections of the George Eastman House are always available to students, publishers and other interested people, for inspection. An information service offers research assistance and provides photographs. This service will now be extended to include radiography.

IMAGE, the quarterly magazine on photography published by Eastman House, contains articles on the history of photography. The current issue features an essay on radiography in 1896 by Mr. Fuchs.

Mr. Fuchs is Supervisor, Medical Technical Service, Eastman Kodak Co., and was one of the organizers of the Biological Photographic Association.

BOOK REVIEWS

HISTOLOGICAL AND HISTOCHEMICAL TECHNICS *by Harold A. Davenport, M.D., Professor of Anatomy, Northwestern University Medical School. W. B. Saunders Co., Philadelphia, 1960, xxii + 401 pp. $7.00.*

The book begins with advice on how and where to get materials with minimum damage and considers some of the relations between living and dead tissues. Then follows chapters on: fixation; washing, dehydrating and clearing; embedding; sectioning; knife sharpening; mounting and covering; staining; fixing fluids; staining; formulae; and under histochemistry: introduction; inorganic constituents of tissues; organic constituents of tissues, polysaccharids, proteins and amino acids, and lipids; enzymes; Schiff's reagent applications; bibliography; and index.

Technics have increased in number and detail. One can write an encyclopedia in x volumes or a monograph on a technic. Davenport has endeavored to provide a guide to help the beginner and this will be criticized by all experts as inadequate from their own viewpoint. The section on histochemistry will be vulnerable as such technics are even less standardized than mere staining procedures and scepticism is appropriate. It is unfortunate that no consideration is given to handling tissues for observation with the more modern interference and phase microscopes. Fluorescence microscopy is mentioned only as a possibility. This reviewer would recommend deletion of unnecessary material on stropping a microtome knife and using the space for preparations of unstained living tissues.

Despite the limitations, the book should be a good starting point for learning microscopical proparation technics and the general sections will help the photomicrographer understand some of the problems of preparing tissues for analysis and illustration.—O.W.R.

THE YEAR'S PHOTOGRAPHY — 1960. *R.P.S. publication. (London, England.) 7¼ x 9½ inches. Paper Cover. 95 plates, 2 in color.*

This eagerly awaited photographic annual, now in its 38th consecutive year of publication, again presents the choice of all of the exhibitions held in the Society's House during the past year. These various exhibitions were in many photographic fields, including pictorial, photo-journalism, over-seas members' works, the Bird portrait exhibition, the Newbery architectural exhibition, and nature.

Due to the high quality paper used, the reproductions are excellent, some are in beautiful color. In some cases the division lines are crossed, with pictorials becoming architectural, and portraits and architecturals becoming good entries in the pictorial and advertising classes.

The origins of the entries are worldwide, with seven USA photographers being represented with nine entries, a good average out of the 93 plates in the annual. The noteworthy point to be stressed in the chosen works is the nearly flawless technique, coupled with the fine artistic approach to the subject matter.

This is a most worthy addition to the library of every serious professional and amateur photographer.

One of the important sections of this annual is the expert appraisal of, and commentary on the selections, by the very able and charming President of the RPS, Miss Margaret F. Harker, FRPS, whom many USA photographers met personally last year during her trip to this country.

An index of authors, a very useful addition, completes this very enjoyable 1960 RPS Annual.

Ray Miess, FPSA.

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Mode of Preparing Illustrations for Reproduction*

LEO C. MASSOPUST, Editor

WHEN planning a manuscript for publication it is important to determine the salient features which should be illustrated, the approximate number, and the distribution throughout the text. Because of the high cost of reproducing illustrative material the number should be kept at a minimum.

On the editor's page found in all journals, directions are clearly stated concerning the submitting of illustrations.

The methods by which drawings are to be reproduced should be given careful attention. The various processes of engraving have certain limitations which means that in order to obtain best results, original copies must be adapted to a definite process.

Pen, brush and camera are the tools to use. Of these, pen drawings or line drawings are reproduced as zinc etchings and are the least costly. Wash drawings made with the brush, and photographs, necessitate the use of the halftone process which entails two or three times the cost of zinc etchings.

Whenever possible, drawings for a manuscript or book should be made by the same artist in order to maintain uniformity. All drawings should be made on white, blue-white paper or bristol board. Cream-white, yellow tinted paper or board is undesirable.

Line drawings are made with india ink. Lettering and lines should be firm and of sufficient thickness for reduction. All drawings should be drawn somewhat larger than the size estimated for publication. Reduction enhances the quality of the reproduction.

When planning illustrations, the size of the page of the book or journal should be ascertained. Thus, proper proportions of the illustrations may be planned. It is important to allow some space below the pictures for a legend.

The photoengraver can reproduce illustrations the same size or any size larger or smaller than the original copy. When reducing or enlarging, the exact proportion of the copy is retained. For example, an illustration five inches wide by seven inches high, to be reduced in its entirety, is reduced or enlarged always in the proportion of five to seven. The diagram below illustrates the principle of reducing or enlarging while maintaining the exact proportions.

It is desirable, when possible, to group illustrations such as "before" and "after", or "Pre-operative" and "Post-operative" sequences. This will entail less expense than making individual cuts. However, care must be exercised to retain the proper sequence and proportion of the page.

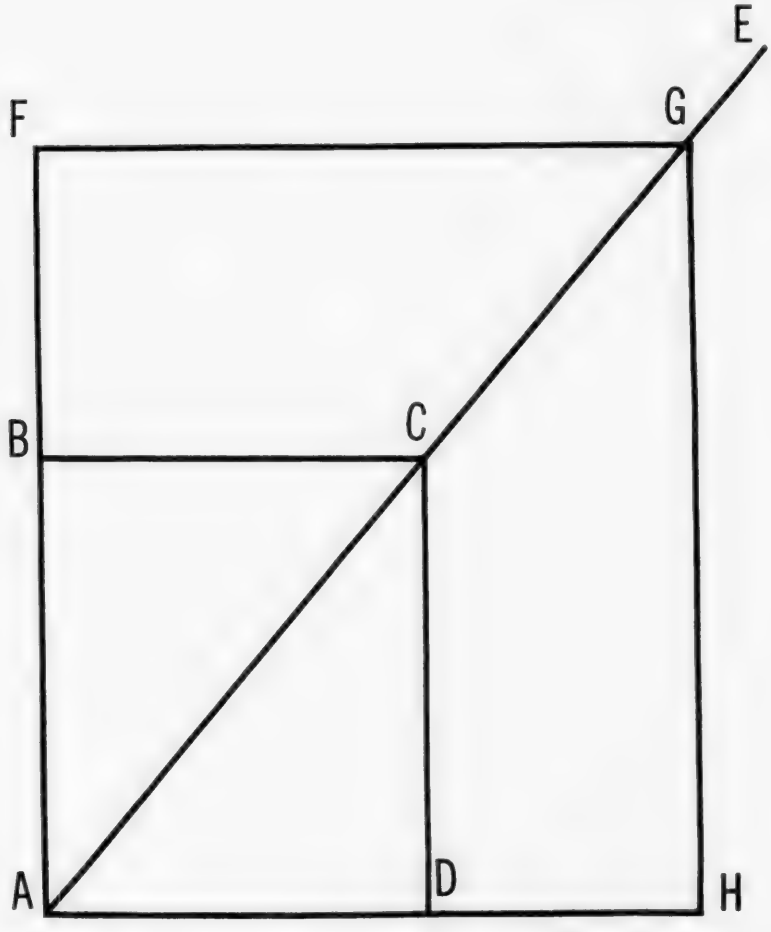
When making drawings, charts or graphs, all numerals and letters should be of sufficient size to make the smallest character clearly legible in the reduction.

* Reprinted from Marquette Medical Review.

Charts and graphs made on graph paper for reproduction should only be made on blue background graph paper. Blue background graph lines will not reproduce, while those in red, green or brown will and thus will appear in the etching.

When labelling drawings or photographs, white characters should be used on dark or black backgrounds, black on light or white backgrounds.

Standard typewriting should never be submitted for reproduction for it reproduces very poorly. However, carbon



Draw the exact measurements of original copy ABCD. Extend diagonal ACE, which will be the diagonal for all reproductions in proportion to ABCD. For example, any line FG is drawn parallel to BC. At G the intersection of ACE, a line is drawn parallel to CD. Therefore AFGH is in the exact proportion to ABCD.

ribbon typewriting which simulates printing very closely is quite satisfactory.

The word "Figure" or "Fig." should never be a part of the illustration, but should be set in type below the cut proper.

All photographs should be made on glossy paper, and should never be rolled. Paper clips should not be used to attach photographs to the manuscript. They will leave indentations in the photograph which will show in the reproduction.

Drawings and photographs should be carefully protected from bending and from having their edges torn in transit to the editor.

Well prepared manuscripts effect economy and assure a minimum of delay in publication.

THE CHICAGO CHAPTER

cordially invites you and your family to attend the

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of the

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August 21, 22, 23, 24, 1961

DOROTHY PINKHAM
Director of Communications
Chicago Chapter

The New Look in Science Education

ARTHUR S. FLEMMING

Secretary Department of Health, Education and Welfare

Elementary and secondary education in the United States is in the midst of a healthy ferment. Everywhere, we see new approaches to curriculum development, new methods of classroom teaching, and new ways of presenting traditional subject matter.

This process of innovation is perhaps most exciting — and most promising — in the field of science. In many schools at the high school and junior high school level, experimentation is supplementing lectures. Youngsters are gaining a deeper understanding of the meaning of inquiry, observation, and analysis — the very essence of the scientific method.

Already high school science projects, fairs, and similar undertakings have produced impressive results. Our young students are demonstrating great insight and keenness of mind and are already making new contributions to scientific knowledge.

Certainly, such promise should be encouraged. It might well be extended, under careful supervision, to as many scientific disciplines as possible. Appropriate research projects in the biological and social sciences can be as exciting and rewarding to high school students as experiments in the physical sciences.

Animal experimentation is at the heart of research in the biological and life sciences. Considerable study, of course, needs to be done on the extent and appropriate nature of such experimentation at the junior and senior high school levels. Many animal studies are too complex for youngsters and, of course, it is important for young students to be thoroughly trained in the humane care of laboratory animals. Thus, biological experiments in secondary schools should be conducted under very careful supervision and guidance.

Nonetheless, I am confident that suitable projects in this field can be developed for students in the junior and senior high schools. Indeed, this kind of supervised training can help develop a more profound appreciation of the value and dignity of life. And it can help advance a vigorous brand of science education in the United States.

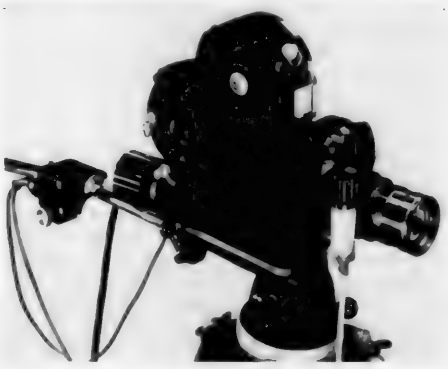
New Products

ULTRA CLOSE-UP PHOTOGRAPHS WITH THE ALPA

Brochure, describing the use of the ALPA 35mm Single-lens Reflex camera for Macrophotography at extreme ratios of 1:1 to 10:1 magnifications, bridging the gap between regular close-ups (infinity down to 1:1) and Microscopic Photography (10:1 to 1500:1). Karl Heitz, Inc., 480 Lexington Ave., New York 17, New York. Brochure sent on request.

NEW MOTOR-DRIVEN ZOOM

A new motor-drive for the zoom movement of the 17-70 Angenieux varifocal lens has just been announced by the Arriflex Corporation of America. The unit is made by Arnold & Richter, West German manufacturers of Arriflex cameras. It consists of a miniature motor



and gear mechanism which is mounted directly on the lens barrel by means of a special split-ring clamp. The control unit is designed to mount on the panhead handle. (See photograph)

The motor-drive and control unit, mounted on the Arriflex 16 as shown, gives the cameraman finger-tip convenience and smooth, readily duplicated zooms. The miniature motor operates from the same 8 volt DC battery pack as the camera. Model 70 varifocal lenses already in the field, as well as new lenses may be equipped with the motor-drive. The new unit makes possible a variety of remote-control applications.

The motor-drive and Model 70 Angenieux are both available through franchised Arriflex dealers. The motor-drive alone is $249.50. The Model 70 Angenieux sells for $399.00. A small installation charge applies for motor-drive mounting when the units are purchased separately. Additional information may be obtained from Arriflex dealers or from the Arriflex Corporation of America, 257 Park Avenue, South, New York 10, New York.

NEW BOOKLET ON LENSES AVAILABLE TO CAMERA USERS FREE OF CHARGE, FROM EXAKTA!

Bronxville, N.Y. . . . Exakta Camera Company is now offering a new 8-page booklet by Bill Lewis, titled, "Use The Right Lens To Get The Best Picture Every Time".

In this booklet the author stresses the fact that many photographers reduce their success by two-thirds because they rely on only one lens to do all their jobs. This, in the author's opinion is wrong, and he states that one would not think of driving a car everywhere with only one gear no more than a photographer should think of taking all pictures with only one lens. "An automobile," he states "has three gears forward in order to use the motor to the best advantage under different conditions. By the same token, no thinking photographer expects one lens to do everything" . . . "three lenses gives a person a range of choices to get the best possible picture everytime". This booklet explains the functions of a normal lens, a telephoto lens, and a wide-angle lens, and shows how each lens should be used to the best advantage. The author illustrates with diagrams what each lens will cover with the camera and lens set at the same point or field of view. Mr. Lewis concludes the article by listing various photographic situations that a photographer could be confronted with, and next to it, the lens that should be employed to get the best results. This informative lens booklet, "Use The Right Lens To Get The Best Picture Every Time", is both interesting and enlightening for owners of every camera regardless of type of manufacture. Booklet is available free of charge upon request, from Exakta Camera Company, Bronxville, N.Y.

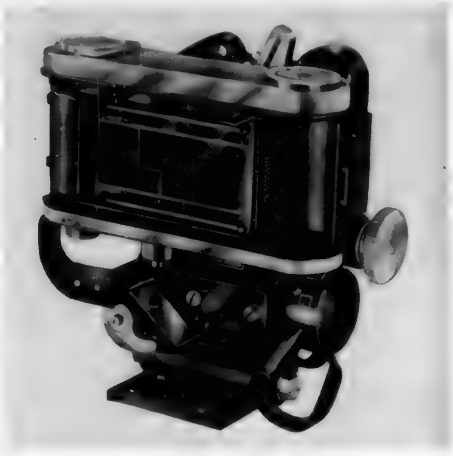
5.7mm KINOPTIK LENS IN THOR MISSILE

Installed in a THOR intermediate ballistic missile and attached to an especially lightweight 16mm camera, the Kinoptik 5.7mm f/1.8 APOCHROMAT (with 113° extreme wide-angle coverage) produced some of the most complete and clearest films of the surface of the earth.

Films from an altitude of 300 miles, the lens covered an area of over 120,000 square miles, recording photographs that were free from distortion and with an unsurpassed degree of clarity, definition and contrast. The price is $499.00. Distributor Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y.

ROBOT RECORDER 24e PROVIDES DOUBLE EXPOSURES

Equipped with a second lens built into the top of the camera, separate prism reflex system and auxiliary shutter, the ROBOT Re-



corder 24e Automatic 35mm camera double-exposes a separate 8 x 8mm image into the corner of the 24 x 24mm frame.

With special ROBOT Kuli e camera holder with reflex mirror and electro-magnetic remote release available for permanent installation, the ROBOT Recorder 24e provides the ideal set-up for recording data, numbers, dials, time, etc. This price is $269.00. Distributor, Karl Heitz, Inc., 480 Lexington Ave., New York 17, N.Y.

NEW BAUSCH & LOMB CATALOG FOR MAGNIFIERS—BOOKLET VALUABLE GUIDE FOR MAKING RIGHT SELECTION

Bausch & Lomb has revised the very popular descriptive catalog which covers a complete line of readers and magnifiers. New items have been added to the 14-page illustrated booklet, which lists over 65 individual models (powers from 2x to 20x). Specifications and prices are included for an extensive selection of round and rectangular readers, folding pocket magnifiers, watchmaker's loupes, surface comparators, enlarging focusing magnifiers, etc.

Businessmen, teachers, students, technical personnel and others, who use magnifiers for any purpose, will find the introductory text

especially valuable. Helpful tips on correct working distance, how to determine magnifying power, field of view factors and the proper magnifier for individual job requirements are discussed in detail.

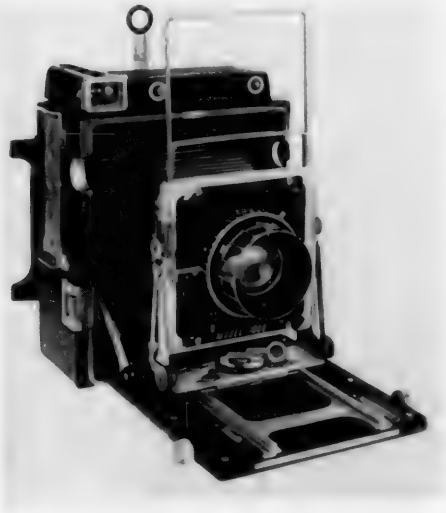
The booklet is available free by writing to Bausch & Lomb Incorporated, Rochester 2, N.Y., specifying Catalog I-103.

PACEMAKER GRAPHIC 45 NOW AVAILABLE WITH 1/1000 SEC. SHUTTER

The outstanding success and popularity of the Graflex 1000 Shutter, introduced on the Super Speed Graphic camera, has led Graflex Inc. to adapt the shutter to the Pacemaker Graphic 45 camera.

The Graflex shutter for use on the Pacemaker Graphic camera is the same unit used on the Super Speed Graphic, with the addition of three contact posts (for M, X or MX synchronization) built into the lens standard.

The new shutter offers: (1) Large conveniently located press focus O-C lever which opens both shutter blades and diaphragm



leaves. It can be operated either before or after the shutter is cocked, (2) Cocking action — easier and more convenient, (3) Click speed and diaphragm settings, (4) Shutter speeds can be selected before or after cocking. Positive provision for M or X synchronization. No lever to be shifted, (5) Built-in lenshade and filter holder, (6) All readings visible from the top.

The shutter has a top speed of 1/1000th of a second at its full one-inch aperture, and it is the fastest, most accurate between-the-lens shutter ever developed. It permits high-speed pictures with complete uniformity of exposure without the limitations normally associated with other shutters. It produces sharper negatives because of its superior motion-stopping ability throughout the full shutter speed range.

The Graflex 1000 shutter achieves its operational efficiency at any given speed by the unique opening and closing its shutter leaves faster than any other shutter. The unusual eliptical blade movement of the Graflex 1000 shutter minimizes shutter vibration and subsequent damage to components. The elimination of shock, vibration, and shutter bounce means less maintenance and prolonged shutter life.

The efficiency of the Graflex 1000 shutter is based upon the close time relationship of the effective time (the ASA standard which rates between-the-lens shutters on the basis of light admitted) and the total time (time from the beginning of opening to the end of closing cycle of a shutter) of operation. This high efficiency, in addition to superior motion-arresting ability, means that shutter speed ratings are virtually unaffected by changes in lens aperture. The list price of the Graflex 1000 shutter for the Pacemaker 45 model camera is $189.50. If the camera to which the lens is fitted has the Graphic Rangefinder, a cam (list price $2.00) must be added.

For further information on installing the Graflex 1000 shutter on the Pacemaker 45, see your nearest Graflex dealer, or write Department 124, Graflex dealer, or write Avenue, Rochester, New York.

NEW BALL-SOCKET GYROSPHERE JUNIOR TRIPOD

S.O.S. Cinema Supply Corporation announces its new ball-socket GyroSphere Junior Tripod.

By means of a single bull's-eye spirit level, the top plate is horizontally adjusted no matter how tilted the tripod or uneven the ground.

Both friction and fluid heads are accepted by the GyroSphere and work independently of it. Present owners of S.O.S. Junior and

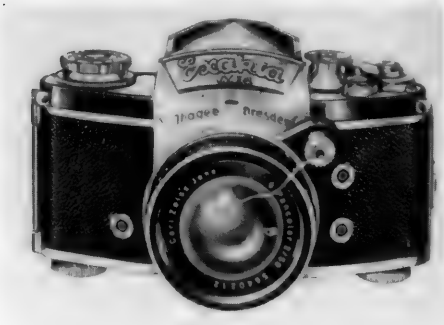
Professional Junior Tripods may purchase the ball socket and adapter for installation on their tripods. Other features include twin-point shoes and one piece leg locks.

Joseph A. Tanney, President of S.O.S. stated, "This new addition to our line of tripods enables easy leveling of the camera. There is no longer any need to be bothered with minute leg adjustments which waste a great deal of time during production. Just level the ball, that's all."

Literature may be obtained by writing to S.O.S. Cinema Supply Corp., 602 West 52nd Street, New York 19, N.Y.

NEW CARL ZEISS JENA PANCOLAR F/2.0 LENS WITH NEW INSTANT RE-OPEN AUTOMATIC DIAPHRAGM FOR EXAKTA

Exakta Camera Company is proud to introduce a new Zeiss lens for the Exakta — the Pancolar 50-mm, f/2.0 in a new Ebony and Chrome Mount with an instant re-open Automatic Diaphragm. This new lens is unique, as it is nearly half the size of other normal focal length lenses. The new Automatic Pancolar lens always remains wide open at



f/2.0 for focusing and composing at full aperture to assure a very bright, easy-to-see image on the ground glass. A single pressure on the release button closes the lens down automatically to the pre-selected aperture and trips the shutter, then re-opens to its widest aperture. The Pancolar can also be operated manually. Diaphragm stops are f/2.0, 2.8, 4, 5.6, 8, 11, 16, and 22. The focusing mount has a dual scale with calibrations in feet and meters with a range from infinity down to 1.7 feet. An engraved depth of field scale shows at a glance the area that will be in sharp focus.

The Pancolar is a coated, six-element lens which possesses a high degree of symmetry. It is corrected for spherical and chromatic aberration with an unusual balance existing between the axial chromatic and spherical aberration with regard to wave length. It is free of most optical imperfections, also coma and astigmatism.

The Automatic Exakta VX-IIa with Penta Prism & Rangefinder with f/2.0, 50-mm Carl Zeiss Pancolar lens is priced at $359.50. Separately, the lens is priced at $140.00.

For more information, write to Exakta Camera Company, Bronxville, New York.

CHROMEGA SYSTEM FOR MINIATURE NEGATIVES ANNOUNCED BY SIMMON BROTHERS

The CHROMEGA system of color print enlarging with dial-controlled filters and a revolutionary new condenser-less illumination system has now been made available for 2¼ x 2¼ and smaller negatives, announced Fred Simmon, president of Simmon Bros., Inc., Long Island City, N.Y., makers of the Omega enlargers. The new B-10 enlargers follow the design path successfully opened by the Chro-

mega D-4 introduced one year ago for 4 x 5 negatives and smaller.

This new system brilliantly solves the two most vexing problems that have plagued the darkroom worker trying to make quality color prints: the control of color and the suppression of surface scratches.

In the past, color has usually been controlled by filter packs which were placed into filter drawers of so-called color heads. These filter packs had to be laboriously assembled and changed by hand, a slow, expensive, cumbersome, inaccurate method limited to relatively coarse steps of gradation. In the new Chromega, the operator merely dials his desired color correction.

The new way provides fast, convenient, precise and stepless color control from O-120 and completely eliminates any necessity of even touching filters by hand.

The Chromega enlargers are exceedingly versatile, and while designed primarily for color prints using Ektacolor paper (or other similar makes), they are by no means limited to this application. By shifting the position of the filter assembly the Chromega becomes an excellent black-and-white condenser-less enlarger, particularly suitable for portrait work and high magnification prints. The nature of the illumination suppresses scratches, retouching marks and dust specks, eliminating print spotting.

The Chromega B-10 is a manual focus enlarger for the miniature camera owner, printing from 35mm to 2¼ x 2¼ color films.

A synchronous timer is standard equipment with the B10 to insure the precise timing required for color.

The new illuminating system and lamphousing will be available separately, to fit existing Omega B-8 and Automega B-7 enlargers.

The Chromega B-10 will be delivered to stores by November 15, priced at $425.00 (approximately).

For further information, write to Simmon Brothers, Inc., 30-28 Starr Avenue, Long Island City 4, N.Y.

REVISED EXPOSURE RATINGS FOR DU PONT PORTRAIT FILMS

Exposure ratings based on the new American Standards Association procedures have been announced by Du Pont for its portrait films on "Cronar" polyester photographic film base.

The new values are:

DU PONT SHEET FILMS	ASA
"Cronar" Press	400/7°
"Cronar" High Speed Pan	320/6.5°
"Cronar" Arrow Pan	320/6.5°
"Cronar" "X-F Pan"	125/5°

The first figure, or exposure index, is about double the previous rating since the extra safety factor allowed under the old system has been eliminated. Actual film speeds remain unchanged, Du Pont said.

The second number, or speed value, fits into the new Unit Value System, a simplified additive method for determining exposures.

The revised ratings for Du Pont films will appear in direction sheets and literature as new printings are made.

Thomas Spackman II, Public Relations Department, Nemours 7531, Wilmington 98, Del., PRospect 4-2762.

NEW EXAKTA PRICE LIST

Exakta Camera Company has just published a new 4-page illustrated Price List No. 29, which is available Free, upon request. This new price list contains 43 illustrations, and lists over 166 items in the Exakta System of Photography. When requesting the New Illustrated Exakta Price List No. 29, write to Dept. J., Exakta Camera Company, 705 Bronx River Road, Bronxville, N.Y.

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FELLOWSHIP PROCEDURE

Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Mrs. Maria Ikenberg, University of Illinois, 904 W. Adams Street, Chicago 7, Illinois.

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